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Proceedings....SECOND COTTONSEED PROCESSING CLINIC

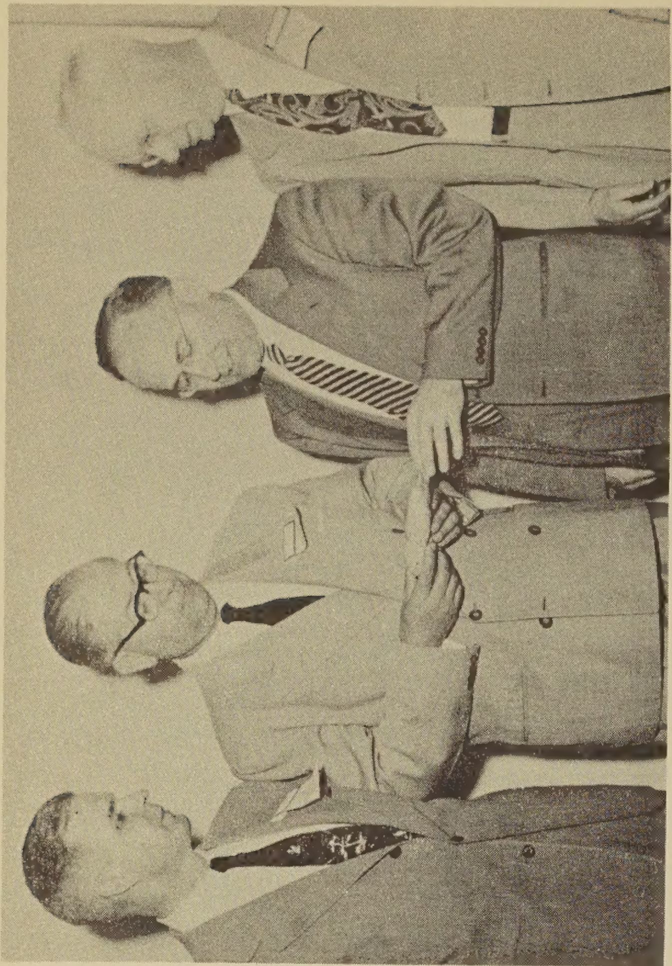
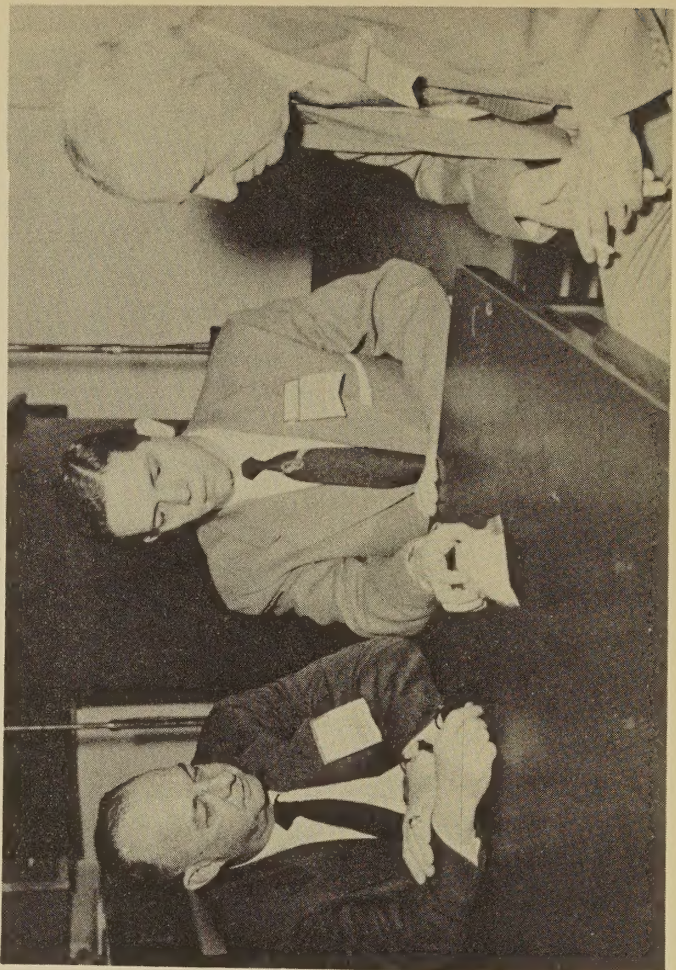
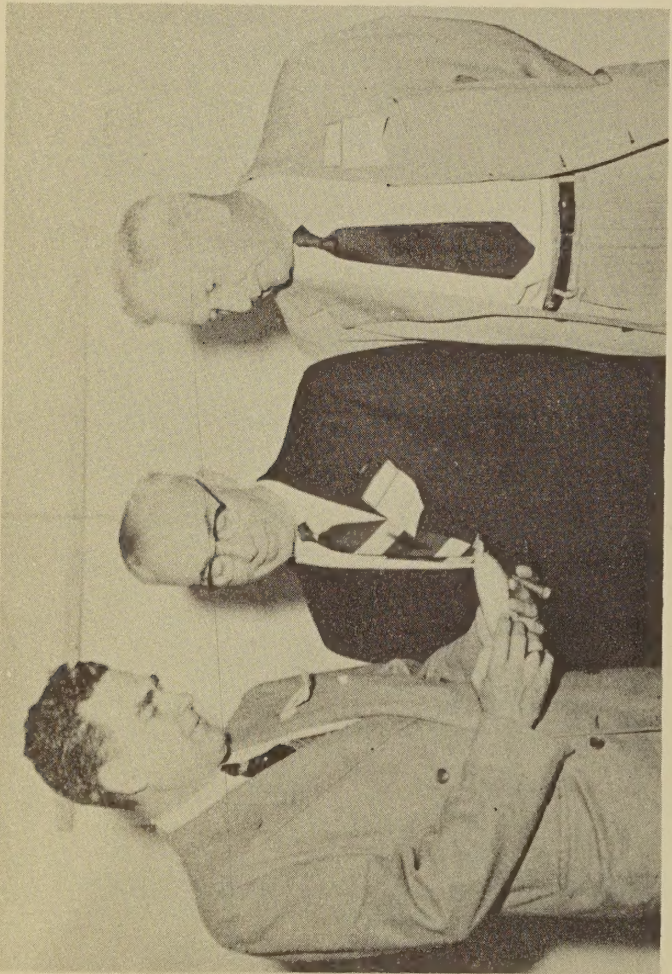
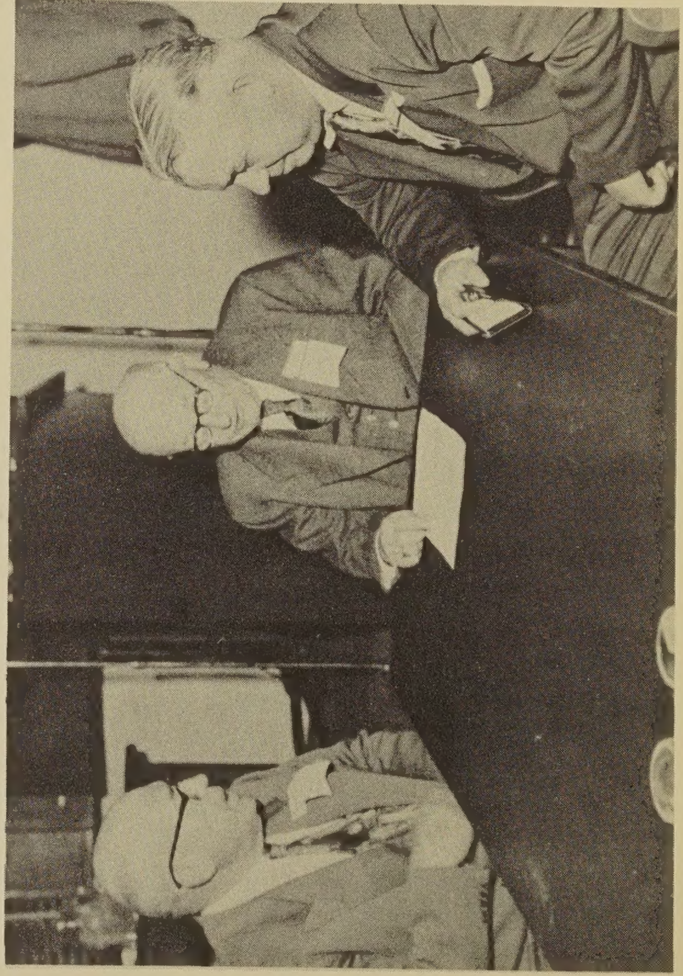
at the

SOUTHERN REGIONAL RESEARCH LABORATORY
New Orleans, Louisiana

in cooperation with

VALLEY OILSEED PROCESSOR'S ASSOCIATION

March 9-10, 1953

Upper Left: Better cleaning of cottonseed, a featured subject at the second Cottonseed Processing Clinic held at the Southern Regional Research Laboratory in New Orleans, March 9-10, is discussed by Allen Smith, Memphis, Tenn.(holding sample of cottonseed) with M. D. Woodruff, Springfield, Ohio, and Lucian Cole, Fort Worth, Texas.

Upper Right: Examining a sample of bolly cottonseed at the second Cottonseed Processing Clinic held at the Southern Regional Research Laboratory in New Orleans March 9-10, are J. W. Dunning, Cleveland, Ohio, W. B. Stone, Cairo, Ill.,President of the Valley Oilseed Processors Association, Dr. C. H. Fisher, Director of the Southern Regional Research Laboratory, and G. H. Hickox, Knoxville, Tenn.

Lower Left: T. P. Wallace (center), Memphis, Tenn., discusses the use of pneumatic linter attachments with Dick Taylor (left), Waxahachie, Texas, and F. L. Gerdes, Stoneville, Mississippi, while attending the second Cottonseed Processing Clinic held at the Southern Regional Research Laboratory in New Orleans March 9-10.

Lower Right: Plans for attacks on linter cleaning problems were reported at the Second Cottonseed Processing Clinic, held at the Southern Regional Research Laboratory in New Orleans March 9-10, by M. C. Verdery, Houston, Texas, F. M. Wells, Cincinnati, Ohio, and J. R. Mays, Jr., Memphis, Tennessee.

F O R E W O R D

The information summarized in these proceedings was presented at the Cottonseed Processing Clinic held at the Southern Regional Laboratory, New Orleans, La., March 9-10, 1953.

This Cottonseed Processing Clinic, a working conference, was called jointly by the Bureau of Agricultural and Industrial Chemistry and the Valley Oilseed Processors Association. The program for the first day was arranged and conducted by staff members of the Southern Laboratory, and for the second day by officials of the Association.

Staff members reviewed the laboratory research program on cottonseed and cottonseed products with particular emphasis on the relation and application of research results to the practical operating problems of the industrial processor. The Association speakers were particularly concerned with the cleaning of cottonseed and linters.

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OPENING REMARKS

By
C. H. Fisher, Director
Southern Regional Research Laboratory

Just a year ago I had the pleasure of welcoming you to the First Cottonseed Processing Clinic which we held at the Southern Regional Research Laboratory in cooperation with your association. Today, as a result of the very fine cooperation between the officers and members of the Association and the Laboratory Staff, I again have the pleasure of welcoming you to the Laboratory and of telling you that we are happy to have you with us.

Our first clinic demonstrated to us that this type of cooperative effort is a valuable means for the exchange of ideas and information and for defining pressing industry problems and in developing programs for their solution. Today, I would like to mention briefly the progress which has been made on some of these problems since the first clinic. The entire effort now being expended to provide improved cottonseed meal on a commercial scale is enormous. This investigation which is being conducted in cooperation with experiment stations, the National Cottonseed Products Association, the cottonseed processing industry, and other bureaus of the Department of Agriculture, has pointed the way to more extensive utilization of cottonseed meal as a source of protein in swine and poultry rations, as well as in feed for cattle.

Two major equipment manufacturers are offering the filtration-extraction process to the industry. One "packaged" filtration-extraction plant is under construction at Greenwood, Mississippi, and is scheduled to be in operation sometime in 1953.

The cleaning of cottonseed and linters, which will be part of the program for this second conference, was pointed out by representatives of the Valley Oilseed Processors Association. In an initial investigation, a member of the Laboratory staff has made a survey of a limited number of oil mills, users of linters, and others and prepared a preliminary report for consideration at this clinic.

In drawing my remarks to a close, I should like to thank the officers of the Valley Oilseed Processors Association and members of the Southern Regional Research Laboratory staff for their help in arranging the conference.

Please let us know if there is anything we in SRRL can do to make your visit in New Orleans more pleasant and convenient.

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RESPONSE

By

W. B. STONE, PRESIDENT

VALLEY OILSEED PROCESSORS ASSOCIATION

Thank you, Dr. Fisher for your welcome.

On behalf of the Valley Association and all those who are here today from the cottonseed industry I want you to know that we are very happy to be with you again at this second annual Cottonseed Processing Clinic, which has been made possible by your cooperation and that of your associates here at the Southern Laboratory.

We appreciate the vast amount of work the Laboratory has done in preparing the program which you are about to present.

We also appreciate the handling of hotel reservations for all those attending this meeting.

I believe that I speak for all those who attended last year's Clinic when I say that it was most interesting and informative. We are indeed fortunate to have the cooperation of the Southern Laboratory and its Staff to assist us in solving some of our processing problems and in helping us to produce new and better products through their research work.

We want to thank Dr. J. W. Dunning, of Cleveland, Ohio, for being with us and taking part in the program today.

We also want to thank Mr. M. D. Woodruff, Mr. Allen Smith, Mr. Dick Taylor, Mr. F. M. Wells, Mr. M. C. Verdery, Mr. Lucian Cole, Mr. T. P. Wallace, Mr. F. L. Gerdes, and our Research Committee Chairman, Mr. Ralph Woodruff, for the part they will take in tomorrow's program.

I would also be amiss if I did not take this occasion to thank the Secretary of our Valley Association, Mr. C. E. Garner, for the very important part he has played in helping to arrange this program.

It is gratifying to see so many friends and members of our industry present here this morning. We know you will learn something worth while from the discussions here.

We assure you, Dr. Fisher, that we appreciate the interest you and your associates are taking in our behalf. We know we will take home some valuable ideas from this meeting.

We sincerely hope that this Cottonseed Processing Clinic will continue to be an annual affair.

Thank you.

SOUTHERN REGIONAL RESEARCH LABORATORY
PRESENTATIONS ON COTTONSEED RESEARCH

AND

GUEST DISCUSSIONS OF INDUSTRY PROBLEMS

The Research Program of the Bureau on Cottonseed

by

T. H. Hopper

Southern Regional Research Laboratory

Research on the processing and utilization of cottonseed is not a new interest of the Bureau of Agricultural and Industrial Chemistry. For example, the National Cottonseed Products Association has maintained a research fellowship in the Bureau for more than 25 years. With the organization of the Regional Research Laboratories, the effort was enlarged to constitute a comprehensive program of research that is now conducted in three divisions of the Southern Laboratory: the Oilseed Division under A. M. Altschul; the Engineering and Development Division under E. A. Gastrock; and the Analytical, Physical-Chemical, and Physics Division, of which I am the Head.

In planning the present program attention has been and is being given to problems of basic and immediate importance. The composition and variability in composition of cottonseed has been investigated to provide basic information. Efforts have been expended to improve the storageability of the seed.

The problems of processing the seed for oil and meal have been surveyed and critically examined. Hence, attention has been directed to the preparation of the seed for processing by hydraulic, screw-pressing, and solvent extraction. A filtration-extraction process for oil recovery, recently developed, has received a large amount of public interest and attention.

Much background research has been completed in regard to the processing conditions required for the production of meals of greater nutritive value and of oils of higher quality. In this connection the operation of several commercial mills have been surveyed and the properties and reactions of gossypol examined. Currently, additional attention is being given to the development of a practical laboratory for predicting the nutritive value of the meals. The factors influencing oil color are being investigated, especially screw-pressed oils.

The refining, hydrogenation, and winterization of oils have been the subject of a number of past and current researches. Methods of refining have been examined particularly.

Within the past year efforts have been increased on reacting and modifying cottonseed fatty acids in a search for new uses for new fat products. A recent development is the production of acetoglycerides which give promise of use as flexible coatings, in global spreads, and as plasticizers.

The preparation of fats and oils for use in the formulation of fat emulsions for intravenous injection is under investigation with funds provided by the Office of the Surgeon General.

The research at the Eastern Laboratory on animal fats and at the Northern Laboratory on soybean oil are both directly and indirectly contributing to problems of utilization of cottonseed oil.

Fundamental research on the chemical composition and physical properties of cottonseed and their products will continue to receive consideration. The results lay the basis for development of applied nature.

The use of cottonseed meal in baked goods is being investigated in a research contract with the Okmulgee Branch of Oklahoma A and M.

The direction of the program in the future will be guided by the best advice and information we can obtain and will be aimed at solving the problems of greatest urgency and economic value.

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RESEARCH ON CONDITIONS OF PROCESSING COTTONSEED TO IMPROVE THE QUALITY OF OIL AND MEAL

BY

A. M. Altschul
Southern Regional Research Laboratory

For many years most of the progress made in improving cottonseed processing was in the development of improved equipment designed to increase capacity and yield of oil. Attention given to quality of the products was secondary to that given to increased yield of products and reduced cost of processing. In more recent years increased attention was given to the effect of processing conditions on the quality of the oil; but until only very recently the nutritional quality of cottonseed meal as affected by processing conditions received relatively little attention. With the increases in population and the reduction in number of workers available for agriculture, pressure has been increasing to derive the maximum benefit from the acreage now available and in use for agricultural production. This maximum benefit can be achieved only if products of the highest quality are produced from the agricultural raw material. For this reason, attention is now being directed not only to improving the yield and efficiency of processing of cottonseed, but also to modifications in processing conditions to yield both oil and meal of highest quality.

The nutritive value of cottonseed meal, to swine and poultry, depends upon two factors:

1. Low concentration of interfering substances (gossypol and related materials).
2. High protein value (cottonseed protein, like other oilseed and cereal proteins is damaged by excessive heat and is made unavailable to the animal).

The Southern Regional Research Laboratory undertook in cooperation with industry and nutrition experts to reinvestigate the nutritive value of cottonseed meal as affected by conditions of processing and to develop, if possible, modifications or changes in processing conditions to produce meals of improved nutritive value. To do so, it was necessary to determine the effect of different variables in the processing operation, such as conditions of cooking, conditions of pressing, type of solvent used in solvent extraction, etc., on the nutritive value of the meal. With this information it should be possible to develop new and improved methods of processing and new types of equipment to produce the improved meal.

It was soon clear that any change in processing conditions which affected the quality of the meal would likewise affect the quality of the oil. Furthermore, it became evident that it should also be possible to improve the quality of the oils by changing processing conditions, and that there probably existed a set of conditions which would simultaneously improve the quality of both the oil and the meal. Therefore a program of research which began as an effort to improve the nutritive quality of cottonseed meal through processing was of necessity broadened to a comprehensive program of investigation of the factors affecting the quality of the oil and meal and the development of a process which would simultaneously improve both.

The research being conducted at the present time is based upon the demonstration by this laboratory in cooperation with the cottonseed industry and nutrition investigators of these two facts:

1. Cottonseed meal is a variable nutritional material for swine and poultry. The value depends to a large extent upon the conditions of processing. Cottonseed meals having the same nitrogen, fiber, and oil contents, differ widely in nutritive value when they have been subjected to different temperatures during processing.

2. Cottonseed meal when properly processed has a high nutritive value and can be fed freely to poultry for chick growth and swine. These facts were demonstrated by (1) producing meals of high nutritive value experimentally, by the screw-press process in commercial mills under controlled conditions where meats of low moisture content were not heated above 200° F. before being put through the barrel of the screw press, and (2) preparing a special meal in the pilot plant of the Southern Laboratory under conditions where gossypol was extracted without applying excessive heat during any part of the process. In chick and hog feeding experiments the growth rates with these meals ranged from 30 to 40 percent better than with some commercial meals.

These demonstrations have reopened the entire question of the effect of conditions of processing on the quality of cottonseed meal and have awakened considerable interest among research workers in state and federal agencies, industry, and the National Cottonseed Products Association. Out of this has developed a comprehensive cooperative program of scope large enough to deal with the problem adequately.

The low temperature screw press meals which were found to be very suitable for use in poultry feeds were produced on an experimental basis in commercial mills. Three difficulties were found with this process which would prevent its immediate acceptance by the industry. These are: (1) reduction in through-put of the press by use of low temperature cooking, (2) increase in fines, and (3) increase in the color bodies in the oil which increased the risk of color reversion in the crude oil upon storage for periods of a month or so. Research is continuing to develop means of overcoming such objections to low temperature screw press operation. Meanwhile by calling attention to this information, the cottonseed industry is being encouraged to seek practical means of lowering the processing temperatures wherever possible. The lines of work that must be pursued to solve this complex problem are summarized as follows:

(a) In cooperation with nutrition investigators: On a limited basis, standard meals and specific blends of meals are being furnished to nutrition investigators to solve nutritional problems, such as: (1) development of means of reducing egg yolk discoloration or eliminating it as a result of the small amounts of free gossypol remaining in the meal; (2) determination of the effect of the quality of cottonseed meal when it is blended with other sources of protein such as soybean meal; and (3) determination of the exact amount of lysine needed to improve the nutritional quality of cottonseed meals and the relationship between the boost given by lysine supplementation and the type of processing history that the meal has been subjected to.

(b) Survey of commercial processing: The very interesting results that have been obtained with several prepressed meals indicate that this process should be carefully investigated. Therefore plans have been made to survey the prepress operation in mills selected to be representative of the entire cotton processing area. Samples of meal and oil are being taken throughout the process and analyzed in the laboratory and samples of the meal will be evaluated for nutritional purposes. The results of this survey should provide rather complete evaluation of current commercial practice in the prepressing operation.

(c) Laboratory study of cooking: The theory of cottonseed processing described in the preceding section indicates that one of the most critical operations in cottonseed processing affecting the quality of the products is the cooking operation. Therefore a comprehensive laboratory research program on the variables in cooking is underway. This includes the study of the effect of moisture content, including relatively high moisture content, on the quality of the meal and oil, effect of temperature of cooking, and the effect of addition of chemicals during the cooking operation.

(d) Nature of bound gossypol: Closely related to this study is an investigation in the laboratory of the nature of bound gossypol in commercial samples of cottonseed meal. This study is designed to determine the different types of bonding that take place between gossypol and constituents of the meal during cooking and the properties of these different bonds.

(e) Pigments of cottonseed oil: Because the pigmentation of the oil is critically affected by processing conditions a study has been initiated to isolate the pigments in cottonseed oil and to study their properties.

(f) Initial content of gossypol in seed: The initial content of gossypol varies with samples of cottonseed, depending upon variety and upon the location of growth. A study has been commenced on the effect of the original gossypol content on the quality of the meal and oil when produced by standard conditions of processing in the laboratory.

(g) Chemical measure of nutritive value: Model reactions between gossypol and cottonseed proteins are being studied to determine the effect of cooking on the proteins and other constituents of cottonseed. This is designed to achieve a greater understanding of the type of reactions that result in a variation in nutritive value and to try to arrive at a chemical measure of nutritive value which will be more reliable and which will give closer correlation with actual nutritional measurements than the previous methods which have been proposed.

Some of the commercial meals now available are undoubtedly superior to the average of meals produced by the entire industry and more suitable for swine and poultry feeding. The surveys now in progress will establish whether prepress meals are generally superior to other types of cottonseed meals. Screw-press meals which have not been heated over 200° F. prior to screw-pressing have been fed to chicks and hogs and have been entirely satisfactory as a source of protein. Wide-spread utilization of this latter discovery must await successful completion of fundamental research on the cooking process and development of better methods of refining the oil produced by such a process. These laboratory researches are under way.

This work is carried out with the full cooperation of the National Cottonseed Products Association, its member mills, State Experiment Stations and Federal Agencies.

The Educational Service of the National Cottonseed Products Association has purchased quantities of specially processed cottonseed meal for distribution to nutrition investigators in State Experiment Stations. It has sponsored jointly with the SRRL formal and informal conferences to discuss progress of the program and plan future work and has paid for travel of many who have attended these conferences. It has supported nutrition research at State Experiment Stations on cottonseed meals produced as part of this program. The Association has also supplied fellowships to this laboratory to support this program.

A dozen individual mills have actively cooperated in producing special meals for this program.

Cooperation in nutrition aspects of the program has included research workers in the experiment stations of California, Texas, Arkansas, Louisiana, Florida, North and South Carolina, and Georgia; nutrition experts in the Bureaus of Animal Industry, Human Nutrition and Home Economics, and Dairy Industry, and investigators or several commercial mixed feed manufacturers, as well as manufacturers of amino acids.

Discussion

Dunning: In your studies on the effect of temperature on meal, did any take into account the effect of moisture before the screw press?

Altschul: Yes, they did. Work was done by Dr. Thurber and Mr. Vix. They tried to combine the hydraulic type cook with the screw press operation. The quality of the meal was not good but the quality of the oil was excellent. We concluded therefore that we have not found a set of conditions at which low temperature-moist cooking will give quality of meal equal to low temperature-dry cooking.

Verdery: What quantities of meal do swine and poultry consume? Probably more than cattle.

Altschul: Yes, swine and poultry do consume more meal than cattle. The poultry-turkey market in California brought high prices for meal. One year in Texas, they exported 100,000 tons of cottonseed meal and imported 100 000 tons of soybean meal presumably to take care of the poultry feed demands in Texas. The swine-poultry market is one worth fighting for. This is a point to consider -- the dairy stock and cattle have complicated stomachs with the result that they can eat what swine and poultry cannot. Ammoniated compounds and urea are used as part substitutes in feed for cattle in proportions up to 30% of feed. Cottonseed meal as a result is facing increasing competition from these compounds. It is not only necessary that we try to create new markets but that we maintain the present one. New cooking techniques indicate that it is possible to make a meal of low gossypol content suitable for feeding.

EXPELLER PRODUCED COTTONSEED OIL VERSUS HYDRAULIC PRESSED COTTONSEED OIL

By
Wales Newby* and E. D. Giles
Cotton Products Co., Inc.

This is a study of the relative bleaching quality of commercial refined cottonseed oil which is produced on refining expeller produced crudes, as compared to the quality obtained from hydraulic crudes. The term expeller is used here to designate all types of mechanical screw pressing and bears no relationship to trade names. It is a preliminary presentation assembled for discussion during the cottonseed clinic of The Valley Oilseed Processors Association at the Southern Regional Research Laboratory. It is planned to use the same data for the development of a more detailed publication at a later date.

General Principles

It has been generally conceded in refinery laboratories, and throughout the industry in general, that cottonseed oil produced by expeller pressing is somewhat less bleachable than is hydraulic produced oil from the same grade of seed. What is perhaps not so well known, however, is that the bleachability of refined oil produced commercially from expeller crudes is often much poorer even than is

*Presented by Mr. Newby

indicated by the standard laboratory tests. In other words, the laboratory refining color, which is used as a settlement basis, is a fairly good indication of the bleachability of hydraulic cottonseed oil, but often fails to predict a very poor bleachability for an expeller produced oil.

This question of bleachability is of paramount importance to the refiner and becomes more so every day. Unfortunately, this fact is not taken into consideration in the trading rules covering transactions in cottonseed oil, a shortcoming which badly needs correcting, although it is a deciding factor in soybean oil trading.

In the past, the relatively poorer bleachability of expeller oils was of less importance since only a small proportion of the total cottonseed crop was crushed in mechanical presses. Prior to 1949 less than 10% of the tanks arriving at one refinery were of mechanical press origin, whereas, in 1952 the proportion was 21%. So long as nine tanks of hydraulic oil were available to mix with one tank of expeller oil, the relatively poorer quality of the expeller oil was not so noticeable. But, as the proportion of expeller oil becomes greater, its poor bleachability becomes a serious problem.

Even though the poor bleachability of mechanically pressed oil does not reduce its settlement value under the present inadequate trading rules, it nevertheless behooves the operators of such equipment to become aware of bleachability requirements and to produce as bleachable an oil as possible. Because, cottonseed oil is today faced with ever increasing competition from other oils, some of which are much more easily bleached. So that, if the present trend to mechanical pressing of cottonseed should increase the average refined bleached color of commercial cottonseed oil, these competitive oils would gain a decided advantage with the consumer who demands whiter and whiter products. This could easily reduce the market for cottonseed oil.

Experimental Data

As a basis for comparing the quality of expeller and hydraulic oils, 45 typical tanks of expeller oil were chosen. These 45 tanks represent the entire receipt of expeller oil at one refinery during the period of July 1st, 1952 to March 1st, 1953. This does not mean of course, that only 45 tanks of this type oil was refined, but that the 45 tanks chosen includes at least one tank out of each days receipts from each supplying mill. The supplying mills were scattered over 5 states; Louisiana, Texas, Mississippi, Arkansas, and Missouri.

For comparison to these 45 tanks of expeller oil, 45 tanks of hydraulic oil were chosen to represent as nearly as possible oil from the same area, received during the same week, and having approximately the same FFA. Obviously, there are some cases in which the comparison may be unfair, simply because the nearest hydraulic mill, to a given expeller location, may be seventy five or one hundred miles away, and seed of the same free fatty acid may vary widely in characteristics within less distance. However, since the trends are the same in all cases, whether the comparative mills are very close or not, it is believed that the overall picture is accurate.

In Table I are shown the Laboratory Settlement Color, the Official Bleach on the Laboratory Settlement refining, and the Official Bleach on the actual refined oil obtained by commercial refining. The commercial refining was done in a modern two step system in which first sodium carbonate and then sodium hydroxide solutions are used.

I

Comparing the averages in Table I it may be seen that, although there was very little difference between the average colors of the two types of oil, 6.0 against 5.5, there is a decided difference in their bleachability. The average expeller oil would not produce a bleachable prime summer yellow oil, even by laboratory standards, and the average bleach of the commerically refined oil was 4.4; very poor indeed for a 6.0 refined color. The comparable results on hydraulic oils, however, were quite good. The average bleach on laboratory refinings was 1.9 and commercial refining almost equalled this with 2.5. By comparing the individual results it can be seen that although they vary in degree, they all show the same trends as the averages.

2

This same fact may be demonstrated in a different manner by referring to Figs. 1 and 2. The difference in slope of the two lines shows the difference in relation of laboratory color to commercial refined oil bleach found on the two types of oil. While the difference in number of individual tanks which automatically fall in the B.P.S.Y. range illustrates clearly just how much more poorly the expeller type does bleach after commercial refining.

From these comparisons it can be seen that:

(1) Average Mechanically pressed cottonseed oil, as produced today, is less bleachable than comparable hydraulic oil when refined by the standard laboratory techniques.

(2) When commercially refined, the difference is greater still. The spread between laboratory and plant being more than twice as great for expeller as for hydraulic.

There is one encouraging factor which can be found in the comparisons listed in Table I. That is, the fact that some of the expeller oils are so much better than others. This would seem to indicate that it is possible to operate mechanical presses in such a manner as to obtain very nearly, if not exactly, hydraulic quality oil. The whole trouble may well be in the fact that the present trading basis does not adequately characterize expeller oil, so that no concerted effort has been made by mill operators to produce a more bleachable oil. It is hoped that this communication by showing, for the first time, just what grade oil is obtained by commercial refining of expeller crudes, may stimulate interest in improving the overall quality of this type oil.

Discussion

Moore: Would the older type of refining process, using straight sodium hydroxide, have shown the same commercial results?

Answer: This has been investigated and the answer is, "Yes", the trends are the same although the degree is less." In other words the average commercial bleach in Table I would be reduced to probably 3.5 instead of 4.4 by straight sodium hydroxide refining, but this would still leave the average expeller oil not deliverable on BPSY contracts.

Allen Smith: Is anything known of the actual operating conditions in the mills delivering the individual oils?

Newby: No, not beyond the fact that the mills listed as expeller, used some type of mechanical presses. Undoubtedly, some of the mills are using antiquated equipment and outdated methods, but the same thing is true of the hydraulic mills used as a comparison. Also we have checked on individual mills, and so far, have been unable to find any correlation between the trade name of the equipment used and the quality of oil received. And, even more disappointing is the fact that the alleged most modern of the expeller mills, is not one of those producing the best oil.

Wells: Is the poor red color for expeller oils connected with the reversion of color in the storage of oils?

Newby: Probably, in some cases at least, although no definate data are available on the individual oils used in this study.

Stokes: Has there been any difference in nutritive value between high and low red color oils?

Altschul: No -- not so far as we know.

TABLE I

COMMERCIALLY REFINED COTTONSEED OIL

GRADE PRODUCED FROM EXPELLER CRUDE VS GRADE FROM HYDRAULIC

EXPELLER				HYDRAULIC		
		Bleach			Bleach	
Sample	Lab. Color	Lab.	Plant	Lab. Color	Lab.	Plant
1	5.5	1.9	2.2	5.8	2.0	2.3
2	5.8	2.4	3.3	6.1	2.2	2.8
3	6.3	2.0	2.8	6.1	2.2	2.2
4	4.4	1.5	2.4	4.7	1.5	2.1
5	5.9	2.3	2.8	4.7	1.6	2.5
6	4.9	1.9	2.8	5.0	1.8	2.2
7	6.1	2.4	3.7	5.5	1.7	2.4
8	6.8	2.8	3.8	5.5	1.7	2.8
9	6.3	2.8	3.9	4.7	1.5	1.5
10	6.3	2.8	4.2	4.7	1.9	2.3

TABLE I
(cont'd)

COMMERCIALLY REFINED COTTONSEED OIL

GRADE PRODUCED FROM EXPELLER CRUDE VS GRADE FROM HYDRAULIC

EXPELLER				HYDRAULIC		
		Bleach			Bleach	
Sample	Lab. Color	Lab.	Plant	Lab. Color	Lab.	Plant
11	6.0	3.0	4.0	8.1	3.5	3.9
12	7.6	3.0	3.7	6.6	2.6	3.2
13	8.1	4.3	4.7	6.4	2.4	2.4
14	7.7	4.5	5.8	5.7	2.4	2.7
15	8.7	4.2	4.2	5.2	2.3	2.3
16	7.9	3.7	4.0	7.4	2.6	3.3
17	7.6	3.7	4.0	5.7	2.4	2.8
18	5.9	1.9	2.3	5.5	1.8	1.7
19	6.8	3.2	3.8	6.8	2.7	2.8
20	5.5	1.7	3.0	4.5	1.3	1.8
21	5.7	1.8	3.3	4.5	1.6	2.2
22	5.7	1.6	3.3	4.4	1.5	2.6
23	9.0	5.5	5.8	5.4	1.7	2.7
24	6.6	2,6	3.5	5.0	1.5	1.9
25	5.0	2.0	3.0	4.7	1.2	2.2
26	5.1	2.0	3.5	4.5	1.4	1.7
27	7.6	3.7	8.8	4.9	1.6	2.3
28	5.5	1.8	2.5	4.4	1.1	2.3
29	4.9	1.7	2.6	4.4	1.6	3.0
30	6.3	2.0	3.2	6.3	2.1	2.3
31	6.5	2.6	5.0	6.3	2.4	3.5
32	5.8	2.4	4.7	6.3	2.3	3.6
33	5.8	2.3	5.0	6.3	2.2	3.5
34	5.7	2.4	4.4	6.3	2.3	3.2
35	12.0	6.5	12.6	5.7	2.3	2.6
36	13.2	6.9	12.6	6.3	2.3	2.8
37	5.8	2.5	3.7	3.9	1.0	1.5
38	5.7	2.5	3.1	4.4	1.4	1.4
39	6.9	3.0	4.2	5.2	2.0	2.6
40	7.6	3.5	5.5	4.5	1.4	1.4
41	5.5	1.7	3.2			
42	5.5	1.7	2.7	5.5	1.8	2.0
43	7.9	4.0	7.6	7.6	2.8	3.5
44	7.6	4.2	7.9	5.7	2.0	2.4
45	5.8	1.9	2.8	4.2	1.0	1.4
Average	6.0	2.9	4.4	5.5	1.9	2.5

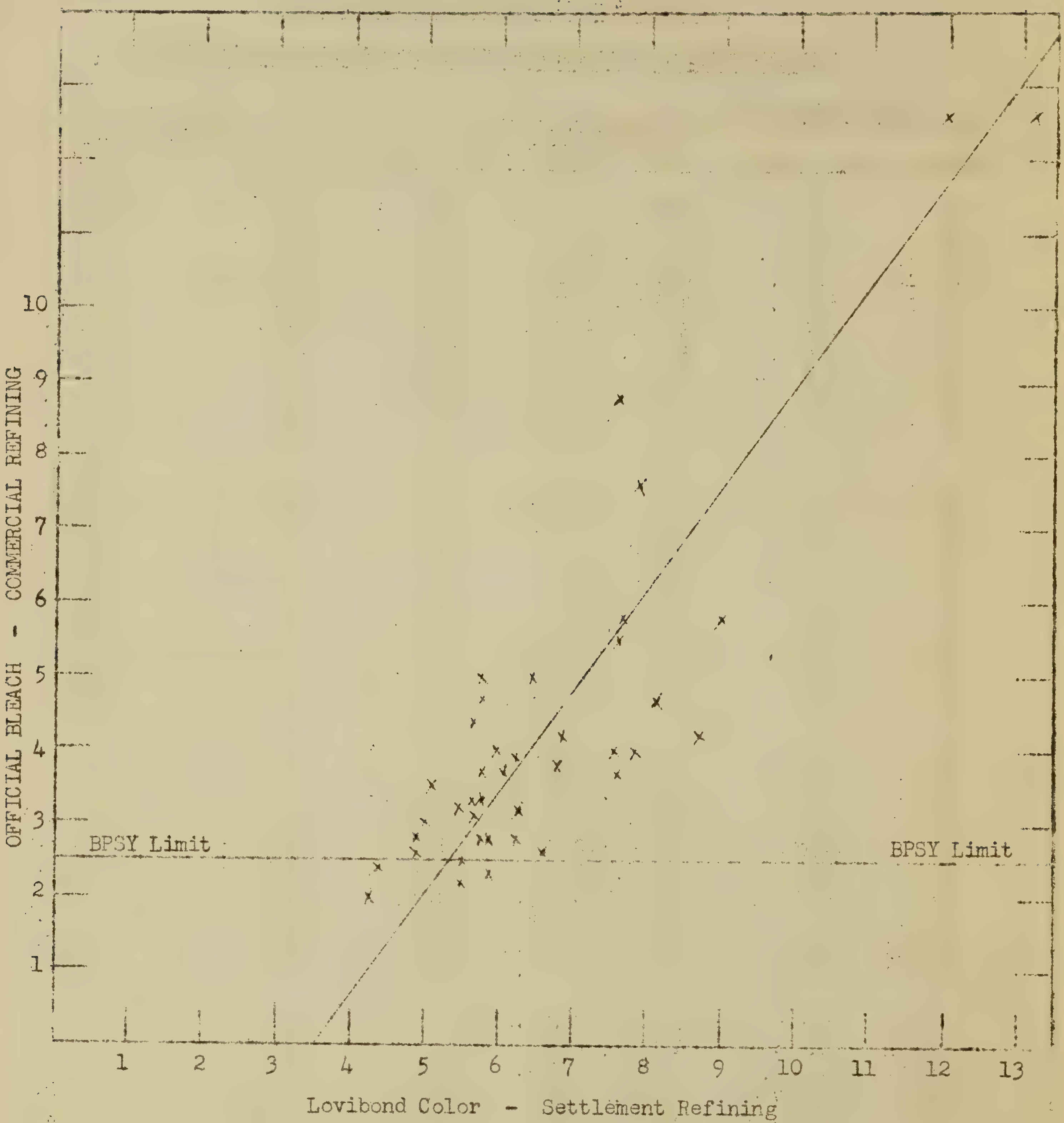

Fig. I Mechanical Pressed (Expeller) Cottonseed Oil
Official Bleach of Commercial Refined Oil
vs.
Lovibond Color on Settlement Refining

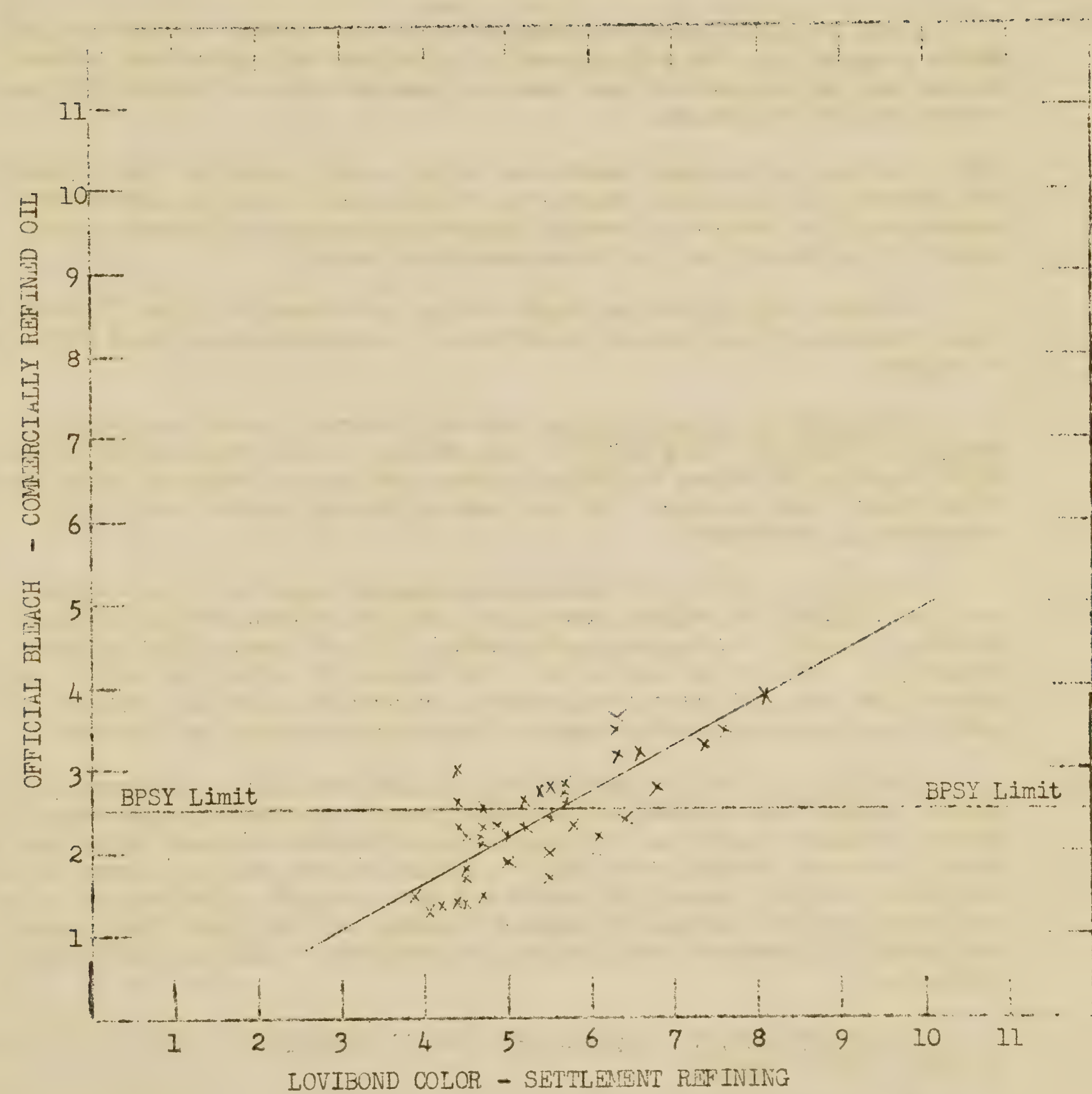

Fig. II Hydraulic Pressed Cottonseed Oil
Official Bleach of Commercial Refined Oil
vs.
Lovibond Color on Settlement Refining

REVIEW OF PILOT-PLANT EXPERIMENTS ON RELATIONSHIP OF CONDITIONS IN PREPARING COTTONSEED TO PROCESSING EFFICIENCY AND QUALITY OF PRODUCT

By
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Since this talk concerns preparation of cottonseed it might be well to define preparation. We will assume it to include all operations between storage and extraction but that does not mean we will not mention storage or extraction for two reasons:

First, storage and storage conditions affect every operation that follows and second, the principal reason for studying and trying to understand preparation is a desire or need to improve processing efficiency, yield, and quality of products, and to reduce operating costs.

It would help also if we could define cottonseed but like "the way of a man with a maid" cottonseed is difficult to understand and more difficult to explain.

Cottonseed as a raw material varies from year to year in quantity quality, and value. In quantity it is geared to the production of cotton. Major planting decisions regarding acreage and size of crop are based on the fiber rather than the seed. So the size of the cottonseed crop is not independently determined.

The quality of the cottonseed crop depends upon the variety grown, the location and the weather conditions and the various practices during planting, growing, harvesting and ginning. All of these affect storage, preparation extraction and so on. The choice of variety of seed is again made on the basis of the fiber produced, or whether a certain variety will grow in a given area, rather than on the yield or quality of the seed.

The value of the cottonseed crop is also variable. Its quantity and quality having been decided for reasons largely extraneous to cottonseed, it enters the market each year in competition with other oilseed materials and faces a variable demand and yield of utilization for each and every one of its products which, except for hulls and meal, are not interrelated. Meal and hulls are used largely for animal feeding, oil for human food, soaps, and industrial products, and linters for upholstery, felting, and chemical cellulose.

The products of cottonseed vary also in quantity per ton of cottonseed in value, and in quality.

The quantity of products per ton of cottonseed is determined for each mill by its physical equipment, the quality of the cottonseed, and the technical skills of the operators; however, for any mill desired high yields of any product must be balanced against the cost of such high yields in terms of actual expense and output. For example, desire for a greater oil yield focuses attention on material balances which indicate where each pound

of oil, bought originally as seed, is finally distributed. It brings about efforts to reduce oil content of hulls, linters, and meal and to reduce any other loss of oil.

The value of the products depends upon their quality and on competition with other similar products.

Competition may lower prices and demand may raise them. In general, wide fluctuation occurs in the value of all of the products from one year to the next.

The quality of the products is influenced largely by initial seed quality but is also profoundly influenced by:

1. Storage,
2. Preparation,
3. Processing methods used for extraction,
4. Holding conditions, after extraction and
5. Product processing methods used.

The above are largely applicable to oil quality but also apply to linters and meal.

The chart shows the various operations between storage and oil extraction that are included broadly under preparation. Some general conclusions will be given regarding the various operations based on pilot plant work at this Laboratory and on work done in cooperation with cottonseed mills. Five processes are covered in the chart: hydraulic and screw pressing, and solvent extraction by the direct, pre-press and filtration-extraction methods. As I discuss the various operations under preparation, it may be convenient to keep the chart before you for reference. The X's on the chart mean the particular operation is usually encountered in the process.

The first operation to be discussed is seed conditioning, Line 2. In our pilot plant work we nearly always use conditioned and equilibrated seed. This is done in order to make our pilot plant studies more reliable, and comparable one with the other. For instance, we could not study adequately changes in rolling and cooking if the tests were made on seed of varying moisture content because the final results might be influenced more by any initial difference in seed moisture than by some of the differences in the experimental rolling and cooking conditions. We prefer to handle seed with an initial moisture content of 7-10% and we usually add a calculated amount of water and hold the seed in drums or other enclosure for 24 to 72 hours to accomplish equilibration.

The operations of cleaning and delintering, lines 3 and 4 will be discussed fully tomorrow so I will pass over them here. For our pilot plant work, we usually purchase seed that have already been cleaned and delintered.

The operation of hulling and hulls separation, line 5, is carried on mainly to facilitate the rolling, cooking and oil extraction operation. Whole cottonseed cannot be processed as efficiently as the meats. A sufficient amount

of hulls, usually the finer portions, are mixed with the meats in order to regulate the protein contents of the final cake or meal in any process used. Our general conclusions are, however, that in practically all cases, better extraction efficiency will result from as low a hull content as practical.

It is obvious that an operator could take full advantage of this improved extraction efficiency and at the same time increase his mill capacity if he could sell his meal products on a protein content basis above the 43% provided by the trading rules. If not, he may find it advantageous to remove as much hull material as possible and to add it back after extraction if the meal product he sells will permit it.

Meats Conditioning. Regardless of the process used adequate meats conditioning ahead of rolling or flaking is a requisite. In our pilot plant work we condition the seed first but in special experimen s to determine the effect of rolling and cooking on free gossypol reduction and on chemical properties of meal, we found important benefits from additional meats conditioning in which the moisture percentage was further increased. In mill operations this is usually done during conveying by the addition of measured amounts of water, steam, or both.

For direct solvent extraction of uncooked meats it is necessary to adjust the moisture content of the meats to the optimum value for producing flakes which have characteristics that will permit satisfactory performance of the extractor. Some processors employing direct extraction prefer to add part of the moisture to black seed and part to the meats; others heat or temper the meats after moisture conditioning to about 170° F. before rolling, as is done in processing soybeans.

Multi-Pass Rolling. Multi-pass rolling is of prime importance in filtration-extraction pre-press extraction, and pressure extraction, where cooking follows. For the direct extraction of uncooked flakes, multi-pass rolling is not desirable because of the great amount of fines produced.

Many mill operators do not fully utilize the advantages of multi-pass rolling. It has been our experience at this Laboratory that to obtain the best results from cooking, in any process, it is necessary to use severe multi-pass rolling of properly conditioned meats, using as high a moisture content as possible without interfering with the operation of the rolls.

Cooking. Cooking of flakes is required for pressure extraction, prepress extraction, and filtration-extraction. The cooking procedure used is similar for all, except that for filtration-extraction the cook is shorter, and a higher moisture content is used. The main purpose of cooking is to promote the flow of oil and thus to render the oil more easily extractable. Among the reported advantages of rolling and cooking ahead of mechanical screw pressing are a greatly increased pressing capacity, reduction in horsepower, and improved oil and meal quality. Cooking also eliminates differences in processing characteristics from one cottonseed lot to another; by permitting moisture adjustment up or down prior to prepressing or direct extraction, cooking lessens the difficulties imposed by the varying moisture contents of raw cottonseed. Moreover, when cooking is used, the final, extracted meal product is a rich, golden-brown color.

Under selected conditions, the rapid reduction of the free gossypol content of the meal to recommended levels (.03% or less) can be accomplished during the cooking steps. Under these conditions the oil produced will also have relatively low gossypol content, making it much less susceptible to color reversion in storage (8). With properly conditioned and multi-pass rolled meats, cooking time can be shortened, and temperatures can be in the low range of 215 to 225° F., allowing meals of relatively high protein solubility.

For Hydraulic pressing, filtration-extraction, and for direct extraction of cooked flakes all of the reduction of free gossypol must be accomplished in the operations up to and including cooking. In the case of screw pressing and prepressing, further reductions of free gossypol can occur in the pressing operation (2, 3).

The cooking operation is essential in filtration-extraction to obtain a material of the proper characteristics to promote rapid oil extraction and easy drainage of liquids on the filter.

Drying and Cooling. In the screw press and prepress processes, drying after cooking is necessary in order to reduce the moisture to a relatively low level to insure proper operation of the press (2). Drying is done either in the lower ring of a stack cooker or in separate equipment, and may involve an increase in the temperature of the meats of up to 250°F. For filtration-extraction, the maximum temperatures reached are not nearly so high (210-230°F.), since the final material does not have to be so dry.

Another difference in the processes is that for filtration-extraction the hot material after cooking has to be cooled to about 140-150° F., to impart the crisp condition which promotes oil extraction, filter drainage, and lessens fines. Evaporative cooling, besides lowering the temperature, reduces simultaneously the moisture to the proper level for extraction.

Prepressing, Grinding, and Reconditioning. This group of operations is required only in the prepress process (2). Prepressing recovers more of the oil than the other three processes. About three-fourths of the oil is removed by the presses leaving about 10 percent in the cake. This oil is usually lighter in color than the oil extracted later. The two oils are generally mixed and marketed as one product.

Considerable power is required in both the pressing and the grinding or pulverizing operations which follow. The resulting granular material is moistened to about 9-10 percent and conditioned at 140-150° F. so that good flakes can be formed (2).

Flaking. One pair-high smooth flaking rolls are used. As has been mentioned with direct extraction of uncooked meats the best possible flaking is required; with direct extraction of cooked meats flaking may or may not be employed. Good flaking is desired for prepress extraction, although in one commercial process the extraction of granulated press-cake, has eliminated the conditioning and flaking steps, with the disadvantage, however, of requiring a longer extraction time and a larger extractor. In filtration-extraction it

Sequence of Various Operations of Preparation Between Storage and Oil Extraction for Fine Methods of Processing Cottonseed

	PRESSING		SOLVENT EXTRACTION		
	Hydraulic	Screw	Pre-Press	Filtration Extraction	Direct
1. Storage	X	X	X	X	X
2. Seed Conditioning	X	X	X	X	X
3. Cleaning	X	X	X	X	X
4. Delintering	X	X	X	X	X
5. Hulling, Hull Separation	X	X	X	X	X
6. Meats Conditioning	X	X	X	X	X
7. Multipass Rolling	X	X	X	X	
8. Cooking	X	X	X	X	
9. Drying	X	X	X	X	
10. Cooling				X	
11. Pre-pressing			X		
12. Grinding			X		
13. Reconditioning			X		
14. Flaking			X		X
15. Screening				X	
16. Grinding (overs)				X	
17. Final Pressing	X	X			
18. Solvent Extraction			X	X	X

is desirable to use a screening operation in conjunction with the evaporative cooling step. This helps to break up the larger agglomerates formed in cooking. The "overs" on a 1/8" screen amount to between 10% and 15% and consist mainly of larger hull fragments which have curled around some finer particles of meats. This portion of the material must be opened up or "reformed" either by a mild rolling or grinding operation in order to promote extraction efficiency.

CONCLUSION: In concluding these remarks on preparation I would like to point out that we have discussed 15 different operations and that each operation has a wide range of values for several imposed conditions, including temperature, moisture content duration and others. The integrated operations included under preparation thus include almost endless possibilities of variability which are adjustable by the proper application of skills so that a variable raw material such as cottonseed can be processed through any one of the processes to produce substantially uniform products of the best quality and for the lowest cost compatible with each installation.

We are adding continually to our knowledge of what to do and how to do it. Close cooperation between research, development, and production has lenghtened our strides. Continued interest support, encouragement, and hard work will help them continue.

IMPROVEMENT IN THE HYDRAULIC METHOD OF PROCESSING COTTONSEED

By
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University of Tennessee

A systematic study of the factors that are believed to control the efficiency of hydraulic pressing has been carried out during the past three years at the Engineering Experiment Station of the University of Tennessee under a contract with the Department of Agriculture. Experiments were made in a small laboratory cooker and Carver laboratory presses to find the effect on residual oil of pressing temperature and moisture, hull content of the meal, total pressure applied to the cake and the rate of application of pressure, cake thickness, and drainage time. The more important results were checked by tests in our operating mill.

The range of variables was as follows: pressing temperature, 140, 170, 210, and 230 degrees F.; pressing moisture, 5 to 15 percent; hull content, 29, 43.5 and 54 percent of the dry, oil-free meal; total pressure on cake, 2000, 2500, and 4000 psi; rate of application of pressure, 67 psi per min., and 500 psi per min.; cake thickness, 3/16 to 2-1/4 inches; and drainage time 7-1/2 min. to 2 hours.

The most significant result of the work was the discovery that there is a definite three-way relationship between residual oil, pressing temperature and cake moisture for every combination of the other processing variables. This was supported by mill tests that were made with an electrically-heated box. Data for typical mill conditions are shown in Figure 1. The star is located at the

cake moisture that will give the lowest residual oil in the cakes at the middle of the press. Since measurements of the cake temperatures have shown that the average temperature of the top and bottom cakes is usually 150 degrees F., or less, it is obvious from Figure 1 that preventing these cakes from cooling would result in a decided improvement. It is believed that this might be done with little expense by insulating the top and bottom of the press. There would be a slight advantage in heating the entire press to about 210 degrees F., and using a pressing moisture about one percent lower than the normal optimum, but it would be necessary to adjust both the temperature and moisture, since an inspection of Figure 1 shows the very peculiar fact that heating the presses without adjusting the moisture can actually increase the residual oil. On the basis of limited work, there is no evidence that either oil or meal quality is impaired by pressing temperatures up to 210 degrees F.

Charts of the type of Figure 1 were obtained for various combinations of the other variables listed above. The results are summarized as follows:

1. Meal should be pressed at the lowest hull content possible and adjusted to 41 percent protein after the cake is ground.

2. In the range of 2000 to 4000 psi on the cake, residual oil is practically independent of total pressure for cake thicknesses of one inch or less.

3. Residual oil is increased about 0.1 percent for every additional 1/16 inch thickness over 1/4 inch up to 1 inch.

4. The minimum residual oil may be lowered by about 0.4 percent by applying the pressure slowly.

5. Residual oil cannot be reduced more than about one-quarter to three-eights of a percent by extending the drainage time beyond 35 minutes.

Discussion

Verdery: Some of the work on this subject was published 2 or 3 years ago. We put copper tubes in the drain pot under the hydraulic press. This additional heat did not give better extraction. The moisture was found to be lower in the heated boxes. All 13 boxes were heated. There was no appreciable increase in oil. Possibly we should have cooked at higher moistures.

Hickox: At that temperature the moisture content is critical. The moisture content must be controlled in rather narrow limits to realize an oil increase.

Unknown: Meal was being put in press at a moisture of 7.5%. The meal was apparently drying out while being pressed. What do you mean by specific moisture?

Hickox: Moisture referred to is the moisture after pressing or the final moisture.

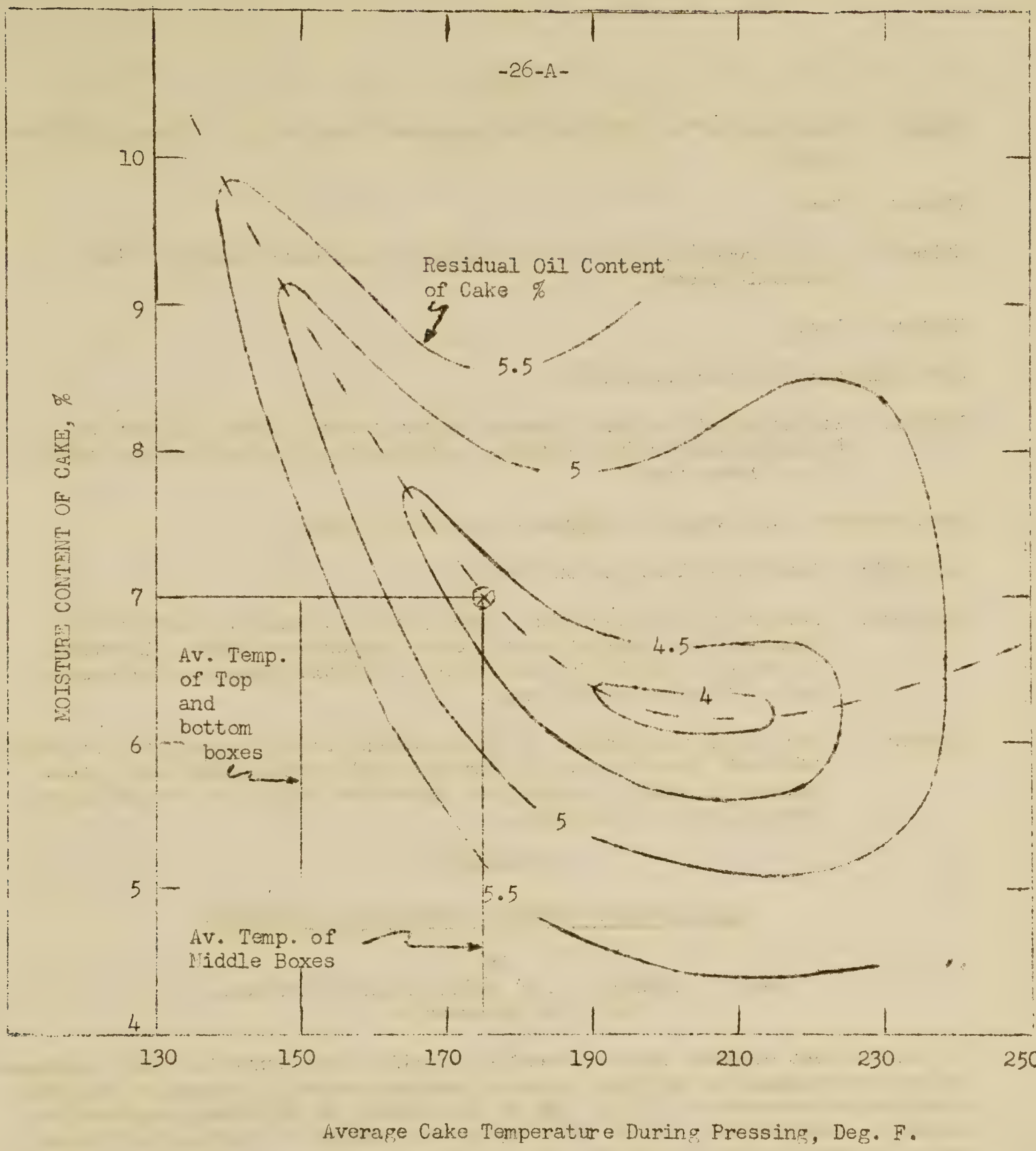

FIG. 1

RELATIONSHIP BETWEEN CAKE TEMPERATURE, MOISTURE CONTENT, AND RESIDUAL OIL (MILL DATA)

Wells: Moisture is "as is"? (As distinguished from dry oil - free, hull-free basis)

Hickox: Yes.

Unknown: Do you recommend that the pressures be increased slowly on the hydraulic press?

Hickox: Yes.

Same Unknown: What are the limits?

Hickox: We increased the cake pressure on the press to 2000 lbs. psi in 4 minutes and to 2000 lbs psi in 30 minutes. We got better results at the lower rate.

Same Unknown: What would this pressure be on the gage?

Gastrock: About 4000 lbs. psi on the gage.

Gastrock: Follow the 5% oil-content curve (on as is basis). There is no change in oil content over a large temperature range. Likewise if you go a little further, there is little change in oil content over a large moisture range.

Hickox: Each range mentioned (by Mr. Gastrock) is only a part of the story. Our test tries to cover the entire field rather than just a line across the field. Juggle your operations until you can get where residual oil is a minimum.

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HIGH CAPACITY EXPELLER PRESSING OF COTTONSEED

By
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The V. D. Anderson Co.

In the last eighteen months, twenty-four mills have converted their equipment to press cottonseed by the high capacity Expeller method. Because of the relatively rapid conversion to this type of processing, we have been requested to review the results that can be obtained by this method of pressing cottonseed and to discuss the factors that influence these results.

High capacity Expeller pressing of cottonseed has come to mean the pressing of the meats from approximately fifty tons of cottonseed per 24 hour day per Expeller. This high capacity operation requires: (1) a good rolling of the meats; i.e., the use of a 5-high 60" mill or its equivalent for rolling the meats from approximately 125 tons of cottonseed per day; (2) cooking of the rolled meats at a minimum of 12% moisture at 190-205°F., for 15-20 minutes; (3) drying the cooked meats to 3-4% moisture content; and (4) pressing the cooked and dried meats in the Expeller.

Of these four steps, the cooking of the meats is of most importance. The attitude that operators of high capacity mills have toward cooking is well summarized by Mr. C. M. Chandler in his article (1) on high capacity pressing of cottonseed. Mr. Chandler

(1) Oil Mill Gazetteer, 57, 25-26 (1952)

states that "cooking ------ is certainly the most important phase of the process. To properly cook cottonseed meats you must adequately roll the meats and you must use sufficient moisture during the cooking step".

The preparation equipment required for high capacity pressing of cottonseed is standard. The Expeller shaft arrangements are the same as used for low capacity work, however the shafts are about doubled in speed so that the vertical worm rotates at 87 RPM and the horizontal worm at 45 RPM. Even though the equipment for high capacity pressing is standard, the equipment and methods of operation must be controlled within certain limits in order to attain the desired results.

Let us now review some of the results from a few mills that are operating high capacity Expellers. The Simmons' Lubbock Cotton Oil Mill at Lubbock, Texas operated four Expellers for a little over two seasons on this type of work. Mr. Chandler, their Superintendent, stated (1) that they averaged 4.25% oil in meal when pressing 50 tons of seed per day per machine. Specifically, (2) Jr. Am. Oil Chem. Soc. 29, 627 (1952) during the month of October, 1951 the Lubbock Cotton Oil Mill Expellers averaged a little over 50 tons of cottonseed per machine per day. The cake produced during this month averaged 4.1% oil; 43.1% protein at 8% moisture. During the month of February of 1951, the machines averaged 51.2 tons of cottonseed per day. During this month the cake averaged 4.0% oil and 44.6% protein at 8% moisture.

Another mill turned in a very commendable job in starting its high capacity Expellers. This mill began operations at an average of 49 tons of seed per day per machine. The values of oil in meal for the first seven days work are given in Table I.

The data in Table II are from still another mill and summarize the oil content of cakes produced over a seven day period two weeks after start up. This mill was pressing 42 tons of seed per day per machine.

TABLE I

Residual Oil in Meal During First Seven Days Operation

Day	Residual Oil
1st Day	4.5%
2nd Day	3.9%
3rd Day	4.2%
4th Day	3.7%
5th Day	3.7%
6th Day	3.8%
7th Day	3.8%

TABLE II

Residual Oil in Cake Two Weeks after Start-Up

Day	Residual Oil
1st Day	4.11%
2nd Day	4.12%
3rd Day	4.20%
4th Day	4.22%
5th Day	4.03%
6th Day	4.07%
7th Day	4.07%

Data from one mill covered the averaged seed, meal and oil analyses for one weeks operation. This mill was pressing an average of 45 tons of seed per day per machine. These data are presented in Table III.

Another mill had a lint room capacity of 120 tons of seed per day. They, therefore, were pressing this capacity on three Expellers at 40 tons of seed per machine. Expellers in this mill, incidentally, have the same shaft speeds as those machines pressing 45-50 tons of seed per day. The oil content in meals produced for three consecutive days are listed in Table IV.

TABLE III

Average Seed, Cake and Oil Analyses for One Weeks Operation

Seed Analysis,%		Oil Analysis	
Total foreign matter	0.2	F.F.A.	0.6%
Moisture	9.4	Refining Loss	3.2%
F.F.A.	0.3	Refined Red	4.5
Oil	19.0	Bleach Color	13 Y - 1.3 R
Ammonia	3.91		

Cake Analysis	
Oil	4.1%
Moisture	8.0%

TABLE IV

Residual Oil in Meal after Two Months Operation

Oil in meal	H2O in meal	Standard
3.52%	8.0%	44
3.58%	8.0%	48
3.47%	8.0%	47

It is interesting to tabulate the oil content of meals produced in different mills, together with the capacity of the Expellers in these mills. These data are given in Table V.

It is important that five of the seven oil content figures in Table V represent average operations for one or more months. The data indicate that there is no discernable relation between capacity of the machine and the oil in the cake produced at these tonnages. Experience in different mills indicate that the specific mode of operation would undoubtedly affect the residual oil more, industry wide, than the difference between 40 and 50 tons capacity. The data does show, however, that an Expeller can press the meats from 50 tons of cottonseed per day yielding a meal containing less than 4.5% oil provided preparation conditions are properly controlled.

What happens when these conditions are not properly controlled? The most apparent result is the production of high oil cake. In addition, the oil may be of poorer quality with respect to both refining loss and bleachability and the filter press cycles may become shorter.

TABLE V

Effect of Expeller Capacity on Oil in Cake

Expeller capacity Tons/day	Oil in cake %
40	3.5
42	4.1
45	4.1
49	3.8
50	4.1
51	4.2
51.2	4.0

In reviewing specific conditions that cause poor results, let us in this discussion assume that a mill is mechanically in good condition; i.e., the conveyors, elevators, feeders and motors are properly sized and the Expellers are in good mechanical order.

The one factor that most often is responsible for poor results in high capacity pressing of cottonseed is the improper control over meats cooking. I should like, therefore, to review several examples of improper meats cooking to illustrate the deleterious effect of this factor on residual oils.

Data from one mill indicate the effect of moisture in cottonseed meats during the cooking stage on the oil content of cakes. This mill was pressing 45 tons of seed per day per machine. These data are summarized in Figure 1. It will be observed that there is a wide variation in oil content of cakes when relatively low moistures were employed during the cooking stage. Although there is no direct mathematical relationship between moisture during the cooking stage and the residual oil in the cake, the data in Figure 1 illustrates that low moisture content of meats during the cooking stage most always results in high oil content cakes.

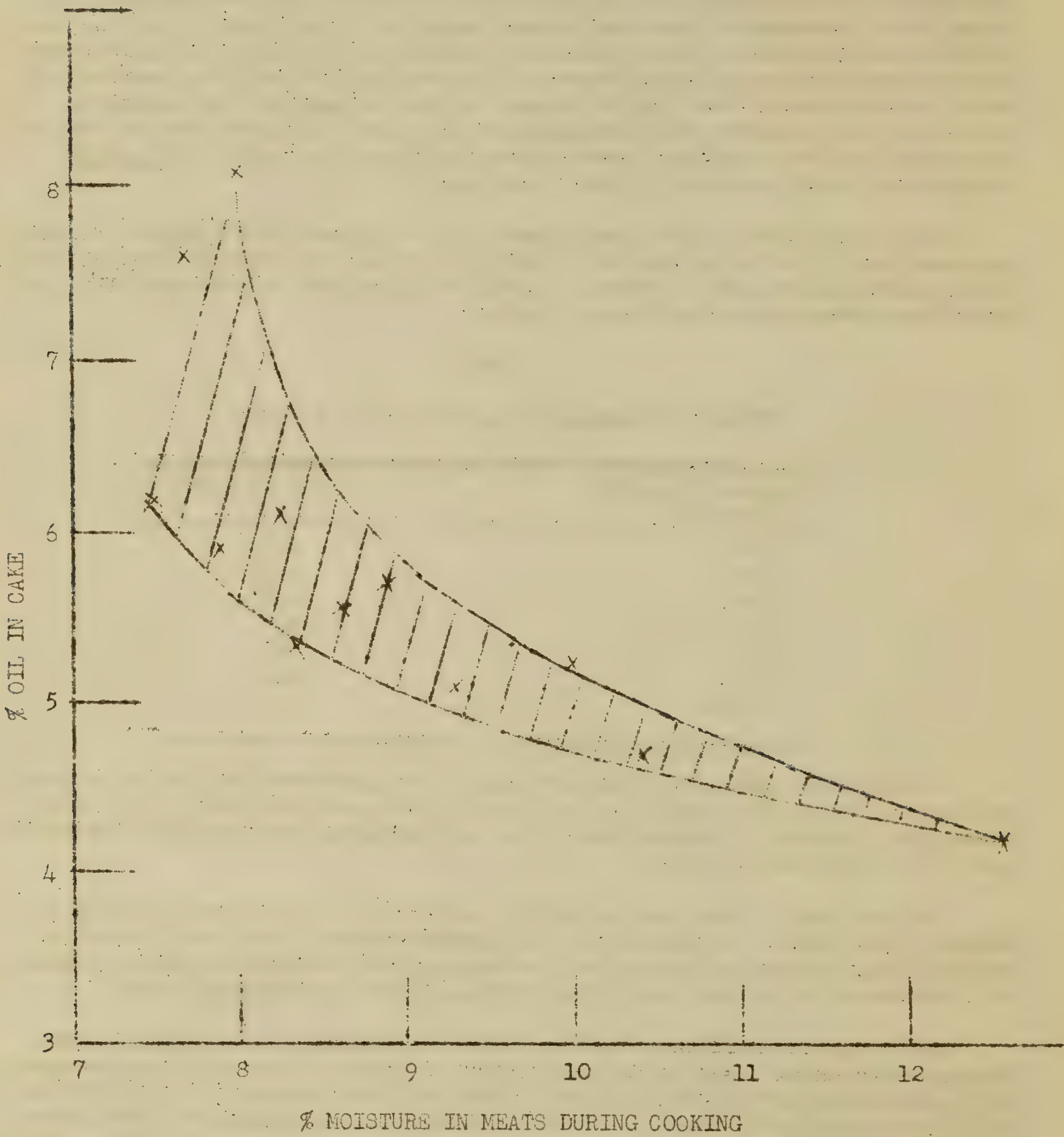


Figure 1. Effect of Moisture in Meats During Cooking Stage on Oil in Meal

Another mill was using three Expellers for high capacity pressing of cottonseed. This mill employed a stacked cooker for the cooking of the meats which was rated at a maximum of 120 tons of seed per day. When operating at a capacity of 100 to 120 tons of seed per day, this mill averaged less than 4.2% oil in cottonseed cakes as shown in Table VI.

TABLE VI

Effect of Cooker and Expeller Capacities on Oil in Cake

Mill Capacity Tons	Expeller Capacity, Tons/day each	Oil in Cake,%	Standard
100	50	4.16	51.6
120-129	40-43	4.19	50.0
150	50	4.52	56.0

Since the Expellers themselves, however, could process more than 40 tons of seed per day per machine, the capacity of the mill was increased to 150 tons of seed per day for the three machines but no additional cooking capacity was provided. During one month's operation at 150 tons of seed per day, the Expeller cakes averaged 4.52% residual oil at 8% moisture. This represents an increase of .33% oil in cake with a plant capacity increase of a little under 30 tons of seed per day.

Without discussing the economic advantages of stretching plant capacity, let us speculate on the effect of further increasing the capacity of the above plant. Although it is not mathematically proper to plot a line through only three experimental points, the speculation in this particular case may be of value. The line in Figure 2 represents our speculation. It indicates that the oil in cakes from the above mill tends to increase noticeably above plant capacity of about 120 tons of seed per day, which is the stated maximum capacity of the cooker. At 150 tons of seed per day through the cooker, the line is curving up rapidly. We would surmise from our speculation, therefore, that if the above mill were to have operated at a cooker capacity above 170 tons of seed per day the cake oils would have been in excess of 4.5%. We would further surmise that when rated cooker capacities are exceeded, cake oils tend to increase rapidly and the entire operation would tend to become more critical.

Still another mill which was pressing 45 tons of cottonseed per day per Expeller was producing relatively high and variable oil content cakes. The temperature of the meats from the cooker ranged from 185-195°F. The moisture content of the meats during the cooking stage ranged from 11 to 12.5%. The meats after cooking were dried to approximately 4% moisture but still the Expeller cakes ranged in oil content from 5-7%. Upon visiting this mill, it was found that although the temperature and moisture conditions in the cooker as indicated by gauges and analyses were adequate, the time of cooking was actually two or three minutes instead of 15-20. It was observed in this mill that water only was added to the meats in the top ring of the cooker. Jacket steam only was being used to raise the temperature of the meats from room temperature to the cooking temperature. As a consequence, the meats were just raised to the cooking temperature

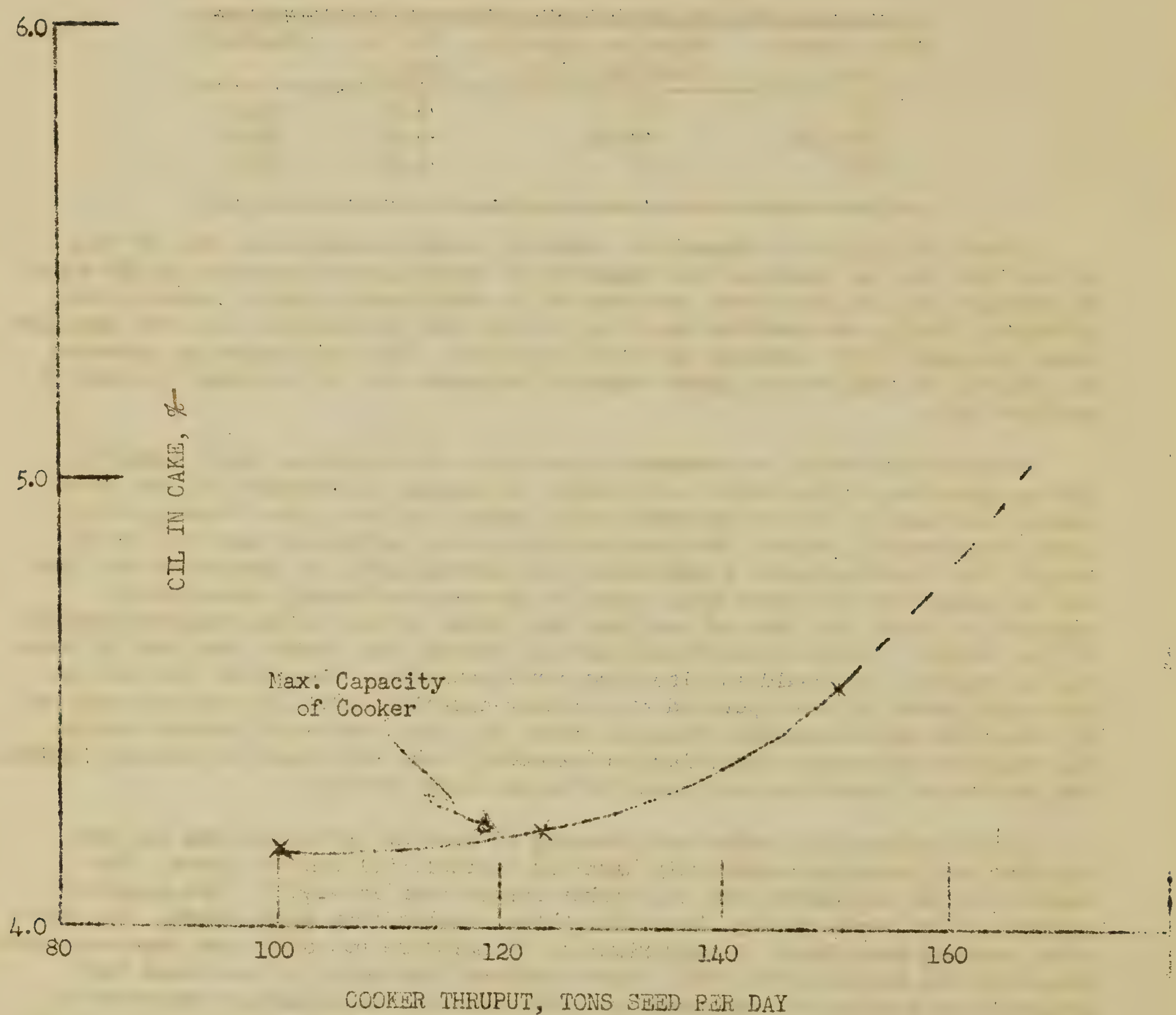


Figure 2. Effect of Cooker Through-put of Oil in Cake.

and then discharged from the cooking vessel without permitting adequate time to complete the cooking process. As soon as sparge steam was used to replace some of the sparge water employed to moisten the meats in the top of the cooker, the Expeller operation corrected itself. Instead of 5-7% oil cakes that were being produced, 4.2% oil cakes resulted. In addition, the proper cooking of the meats increased the time between filter changes four-fold.

There is one factor that must be borne in mind by those mills just starting a high capacity cottonseed pressing operation. One cannot expect the several items of equipment in a mill - the linters, separators, rolls, cooker, dryer and Expellers - to reach equilibrium operating conditions in one or two hours. Adequate time must be given for the various items of equipment to be brought into balance. This is particularly true of the cooker, dryer and Expeller units. It has been observed, for example, that moisture may be more readily evaporated from cooked meats than from raw meats. It is necessary, therefore, to establish proper cooking conditions and then make final adjustments to the drying equipment, rather than to establish drying conditions and then make final adjustments to the cooking equipment.

In the low capacity, single pressing of cottonseed wherein approximately 25 tons of seed per day are handled per machine, rolling, cooking, drying and press maintenance must be controlled in order to produce good quality, slow break oil and to maintain a low oil content in cakes. These same factors of rolling, cooking and drying are even more necessary with high capacity pressing. Whether one is extracting oil from cottonseed in a hydraulic press, an Expeller, a screw press or by solvent extraction, each of these factors play a very great part in the results obtained.

Discussion

Allen Smith: With regard to the amount of live steam added to the meats, what ratio of steam to water is employed to bring the meats up to 12% moisture for cooking? How high do you go?

Dunning: Add as much live steam as your conditioning equipment can handle. Go as low as 11.5% moisture for cooking but no lower. Steam to water ratios of 13 to 12 and 14 to 13 will allow a shorter cooking time. When the cottonseed moisture is at 10%-11% steam only should be used. However, when the moisture drops to 6% use 3 parts of steam to 1 part of water.

Verdery: In rating machines at 50 tons at 48 rpm (standard speed) what do you think difference will be when you drop back to 37 or 24 rpm?

Dunning: I believe that 2-1/2% oil cakes can be made at standard speed. At 25-30 rpm, a lower oil cake is obtained than at 45 rpm. However, this can be vice versa. You cannot correlate percent oil in cake with rpm.

Hickox: Does an increased speed result in an increased cake temperature?

Dunning: No it is just the opposite. The power consumption is slightly greater but you are doubling your capacity at the same time. Generally the cake temperature is lower for two reasons: (1) the moisture in the cake is higher and (2) there is a shorter retention time and less pressure on the material.

Hickox: Does that fact fit on the general pattern of curves that I demonstrated?

Dunning: I can't say.

Hickox: Probably because there are so many factors to be considered.

Dunning: Yes.

Hickox: What is the temperature of the cake?

Dunning: I don't know but it is lower.

Hickox: I can't answer if one quick squeeze would reduce the oil content.

Allen Smith: What is the temperature of the meats to the expeller at the first stage of pressing?

Dunning: Between 220°F., - 240° F. depending upon the amount of drying equipment available.

Verdery: As low as possible and at the same time dry the meal.

Moore: Have you noticed difference is residual oil in seed grown in different localities? Is there any difference in the operation of equipment?

Dunning: We do not yet have enough data to draw a conclusion. The bulk of mills studied are in the dry seed belt.

Moore: They claim that in Arkansas, etc., they cannot get high speed operation and yet get residual oil down to 4 - 4.5%. Is there any foundation to this statement?

Dunning: In Memphis they get residual oil in cake down to 4.1 - 4.2% at 50 tons. Is Memphis in the area of which you speak?

Moore: Yes.

Dunning: If Memphis is in the area of which you speak, there is no question that they can get specified residual oil.

Roberts: What is the percent gossypol in the meal?

Dunning: .02 to .04.

VALLEY OILSEED PROCESSORS ASSOCIATION PRESENTATIONS ON INDUSTRIAL PROCESSING PROBLEMS

COTTONSEED CLEANING AND LINTER CLEANING

DEFINITION OF PROBLEMS

By

Ralph Woodruff, Chairman
Valley Association Research Committee

Early last year when we first began discussing the planning of our first clinic, several of us attended a meeting in Memphis, where the question was raised as to what could be done toward cleaning up our lint. Mills across the country had been laboring to overcome this problem without much success. We were at that time almost through with what had been one of the worst bolly seed crop we had ever garnered. We were, of course, concerned with quality price-wise, but even more we were concerned with the prospect, which was with us constantly, that we might not be able to market our production at all. This situation has not improved except that our seed from the 1952 crop was not quite as rough as before. Even so, we had some linters produced in the Mississippi Valley this year that were not eligible for tender under the Cottonseed Price Support Program and it is assumed they would not have been tenderable on contract if the Program had not been effected. I am of the opinion that favorable weather and a short ginning season contributed more toward our being able to get rid of our lint, than anything we did for ourselves this year.

Be that as it may, we did get some concentration of thought and effort started toward a possible solution of this problem, which is two fold, i.e., better cleaning of seed and better cleaning of linters. The two cannot be separated. They go hand in hand.

It has been our thinking that these difficulties could best be overcome by a discussion of ways and means here between the mill men, the machinery people and the laboratory staff.

A great many of us are working on these problems individually but we feel that we need a clearing house for exchange of information and because it will take all of us working together fast to assure ourselves of a ready sale for our linters in the future. So with these objectives in mind we have arranged this meeting and a program which will afford an opportunity to appraise the progress being made, and spotlight the time and serious effort the processors and machinery manufacturers are devoting to solution of the problem, as well as to determine a future course of attack.

REPORT BY THE SUB-COMMITTEE ON SEED CLEANING

By
M. C. Verdery, Committee Chairman
Anderson Clayton and Company, Inc.

Last year at the first session of the Clinic the following men were appointed as a committee to study methods to improve present means of cleaning cottonseed and attempt to develop improved devices.

Mr. T. P. Wallace
Mr. Allen Smith
Mr. H. D. Reeves
Mr. J. H. Brawner
Mr. H. L. Craig
Mr. M. C. Verdery, Chairman

With such a competent and well rounded committee the Chairman was enthusiasti and entertained high hopes of doing this difficult job in short order and fully expected to be able to give you all of the answers at this session of the Clinic. I now regret to advise that such is not the case.

On September 23, 1952, Memorandum No. 1 was forwarded to all committee members proposing a "Standard Procedure for determining Efficiency of Seed Cleaners" and suggesting it be adopted as the Standard for this committee. Several members acknowledged receipt of this memorandum and agreed with the procedure. A copy of the recommended procedure is attached hereto.

On October 10th Memorandum No. 2 was forwarded to all committee members commenting on various arrangements of seed cleaning in West Texas and suggesting tests and experiments at a large number of mills to determine if there is any significant difference in efficiency with existing equipment and the manner in which it is applied. Allen Smith followed through very nicely and made several tests and studies and will submit a very interesting report. No comments have been received from other committee members. A copy of Memorandum No. 2 is attached hereto.

This committee was fortunate in having some financial assistance from ACCO and complete cooperation from our mill organization at Lubbock. After many tests and experiments, which required hand picking hundreds of seed samples, the following conclusions were arrived at:

A. The proposed "Standard Procedure for Determining Percentage of Recovery" by means of a 2-pound sample of seed is not sufficiently accurate and serious deviations in results were obtained. Quite a few comparative tests were made with 50-pound samples in accordance with standard seed grading procedure but the fluctuations were almost as bad as with the 2-pound samples. In view of these extreme variations in the percentage of foreign matter in cottonseed we believe it will be impossible to conduct a very accurate comparative test by analyzing the seed before and after cleaning. In view of these extreme variations in

the test results we will not burden you with the many pages of test data but will give you only the more significant averages and the data that we feel will be of some value.

B. Over a period of years opinion has been about equally divided as to the advantage, or necessity, of Sand and Boll Reels ahead of Bauer Pneumatic Cleaners. Due to the fact that a large percentage of Mississippi Valley mills have continued to use reels and very few, if any, West Texas mills, would indicate the Reel might be more applicable to seed of higher moisture content. It is also my personal opinion that most mills that were unsuccessful in eliminating reels did not have sufficient pneumatic cleaner capacity. A series of tests were recently conducted at Abilene to determine the efficiency of Bauer pneumatic cleaners, with and without reels. This mill is equipped with three combination Sand and Boll Reels and four Bauer Pneumatic Cleaners, handling approximately 180 tons of seed per 24 hours. Arrangements were made for bypassing the reels and a large number of tests were made as outlined above. The average results were as follows:

REELS AND CLEANERS - % REMOVAL

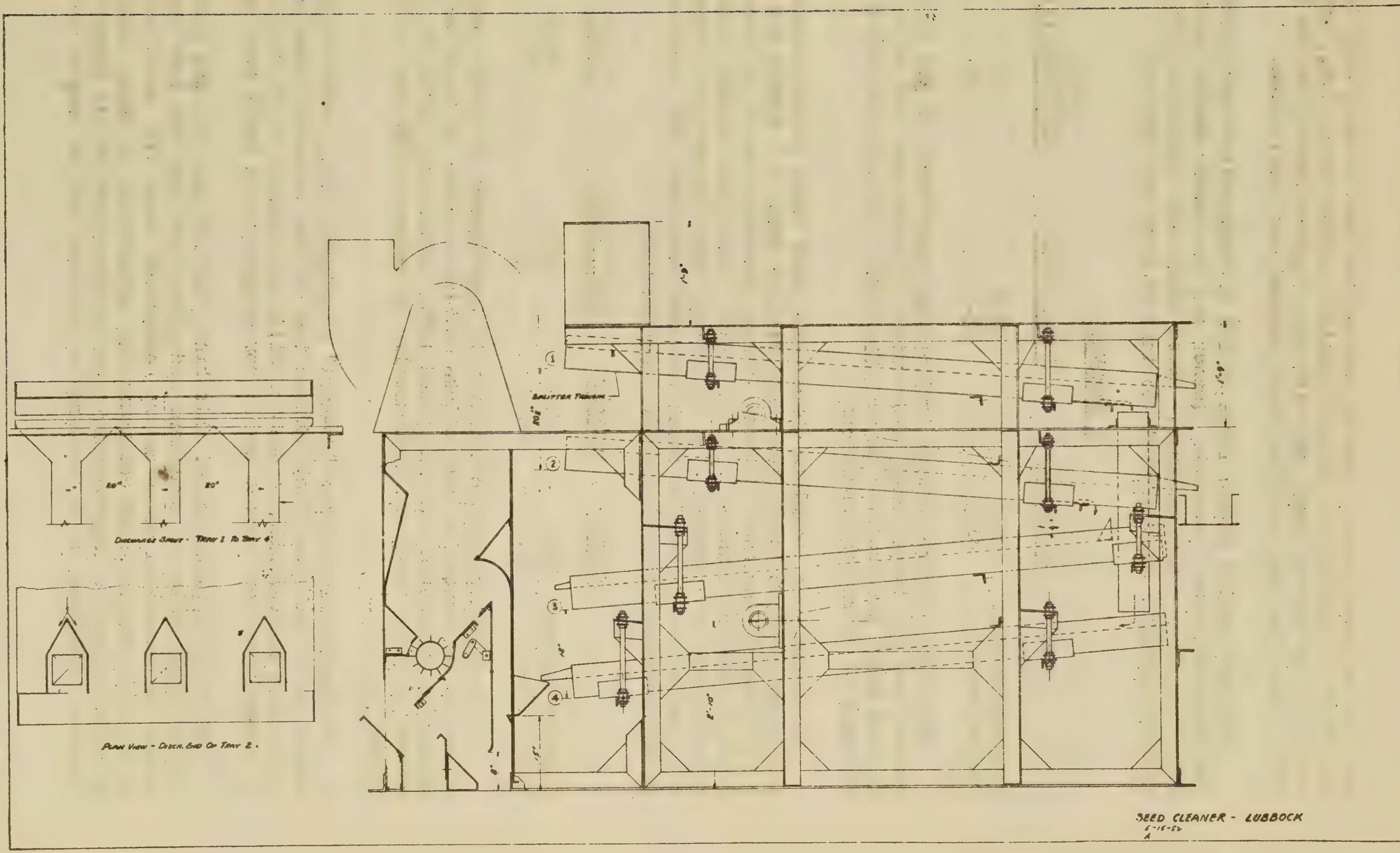
	Fines	Sticks	Other Trash	Total
Reels	72%	11%	13%	23%
Cleaner	93%	39%	60%	59%

CLEANERS ALONE

	Fines	Sticks	Other Trash	Total
Cleaners	95%	40%	56%	59%

From the above it was obvious that the pneumatic cleaners removed just as much trash alone as with the reels ahead of them and that nothing at all was accomplished by using the reels. This conclusion is not entirely in disagreement with the results obtained by Mr. Smith at Memphis where the reels removed 17.5% of the sticks and the combined reels and cleaners removed a total of 30% of the sticks. Had Mr. Smith been in position to bypass the reels he may have reached the same conclusion we did at Abilene. The situation in Memphis might be entirely different from Abilene but I would venture to predict that if Mr. Smith could install one additional seed cleaner, so as to carry a lighter load on each machine, he would be able to eliminate the Sand and Boll Reel.

C. Based on the theory that the limiting factor in the stick removing capacity of the Bauer Pneumatic Cleaner is the screening area and that with greater area it is possible to use smaller perforations on the top tray, a pneumatic cleaner at Lubbock was altered and two extra trays installed. This alteration was made in accordance with the attached drawing which calls for mounting one tray above the present assembly and one below and within the existing frame. By means of splitters under the feeder the load is equally divided between the two top trays



SPLITTER TROUGH
DISCHARGE SPOUT - TRAY 1 TO TRAY 4
PLAN VIEW - DISCH. END OF TRAY 2.
SEED CLEANER - LUBBOCK

and the two lower trays, thereby cutting the load to each tray in half. This made it possible to use much smaller perforations, i.e., nothing over 1/2" on the top tray, and with much lighter loading on the two lower trays the sand and fine trash removal was facilitated.

Average results from a large series of comparative tests between the standard 2-tray pneumatic cleaner and the double decked arrangement with four trays are as follows. These tests were conducted with the cleaners handling approximately 65 tons of seed each per day.

% REMOVAL

	Sticks	Other Trash	Total (Includes fines)
Standard Cleaner	30.8	41.5	50.7
Double Deck	41.3	53.6	59.1

The above average results indicate an improvement of 30% in stick removal and 25% large trash, from which it is obvious that an alteration of this kind, particularly on the upper tray, is justified under almost any kind of operating conditions.

On another very complete comparative test three 8-hour composite seed samples of 50 pounds each were riffled down to 2 pounds and then hand picked giving the following average percent removal on standard Bauer Pneumatic Cleaners at Littlefield. These were checked against five 2-pound grab samples from the double deck cleaners at Lubbock with the following results which indicate more than 100% improvement in stick removal with the double deck machines.

	Fines	Sticks	Other Trash	Total
Standard Cleaner	73.2	18.9	46.6	48.2
Double Deck	91.6	44.2	53.7	58.2

It should be pointed out that this improvement by double decking is primarily in connection with sticks and large trash, in which we are primarily interested, and the added lower screen does little to increase removal of fine trash which is usually in excess of 85% even with a single tray.

D. The application of the "Ro-Ball" principle, i.e., rubber balls suspended under the lower deck perforations of the pneumatic cleaner, is being used successfully at several mills and appears to be very helpful in keeping the herringbone metal from clogging with small seed and meats.

The first application of this kind, that we know of, was made last year by Dick Taylor of Southland and since that time the idea has been picked up by several mills and we understand Bauer will soon be in position to furnish such equipment for application to their machines. By being assured of maintaining clean perforations at all times the cleaning efficiency will certainly be improved and at many mills will

result in a saving in labor.

E. Any discussion on seed cleaning would not be complete without mention of the auxiliary basket cleaner recently developed and being used by Red Callaway at the Plains Coop Mill in Lubbock. This device is certainly not the final answer to the problem but it does recover considerable trash, that would otherwise go to the linters. When Red was confronted with the problem of improving the quality of his chemical linters he designed and built this equipment while most of us were sitting around talking about the problem.

He first built and installed 9" diameter basket cleaners on each first cut linter, to receive the seed as they are discharged from the gratefall. The basket is clothed with 1/8" x 1" vertical slotted metal and equipped with a spiked shaft similar to that used in a lint beater. With the sticks and other trash somewhat reduced in size, after going through the first cut linters, it is effective in removing a portion of the remaining trash. After finding this device successful after the first cut linters, he built similar machines and installed them on the front of the Bauer Pneumatic Cleaners. The seed from each cleaner is diverted and spouted from under the air chamber into the basket and then kicked back into the conveyor under the cleaner.

The basket cleaner on the first cut linters is removing about 5.89 pounds of trash per ton of seed. An analysis of this trash shows it to contain 8.4% sticks, 36.3% other trash, 41.6% small seed and meats, and 13.7% lint. This total removal amounts to approximately .3% and allowing for the seed in meats, would amount to less than .2% trash. The actual stick removal of .03% is almost negligible. In spite of this relatively small percentage of removal with this device it is the best contraption we have encountered for cleaning seed between the first and second cut linters and is certainly a step in the right direction.

The basket attachments on the Bauer Cleaners are removing 1.14 pounds of trash per ton of seed. This is a relatively small percentage of the total foreign matter left in seed but in some cases, particularly where the seed cleaners are heavily loaded, it will do some good and until something better is developed the idea of removing a little trash at every opportunity will eventually add up to a considerable amount.

In Mr. Allen Smith's interesting report covering the Memphis mills he mentioned that during the latter part of the season one mill was working seed containing 2.64% foreign matter and another mill 3.03%. In both cases after passing through the Sand and Boll Reels and the pneumatic cleaners, the seed still contained approximately 1.50% foreign matter. This checks very closely with many of our West Texas experiments which indicated the average seed cleaning equipment was removing less than half of the foreign matter and with the best possible arrangement of equipment, did not exceed 60%.

The West Texas mills have always had the reputation of receiving and working the trashiest seed of any mills in the business. It will

no doubt be of interest that the average foreign matter in the seed received this year by one of the large Lubbock mills was only 1.55%. During the latter part of the season, during the month of February, the seed receipts averaged 3.60% foreign matter. Many individual loads ran as high as 6% and a few as high as 11%.

Most of the West Texas mills have found that in working straight bollie seed, i.e., in excess of 3% foreign matter, it is impossible to produce acceptable lint and have therefore resorted to, and perfected, a procedure for blending seed worked to the mill. By blending, and based on the above mentioned average trash content, it is usually possible to work seed with total foreign matter averaging between 1-1/2% and 2%. With the seed cleaning machinery removing approximately half of this foreign matter they still have somewhere between 3/4 of 1% and 1% foreign matter in seed going to the linters and require careful adjustment of the linters, ample lint beating capacity and every known device and gadget for supplementary cleaning and treating of the lint.

SUMMARY AND RECOMMENDATIONS

A. This committee urges that some better means of determining percent of recovery by seed cleaning equipment or some more effective way of comparing the relative efficiency of equipment be developed.

B. This committee would not care to make a firm recommendation as to the necessity of Reels in the Mississippi Valley but based on experiments and experience in dry seed areas, it would appear that equally good or better results can be obtained by using ample capacity of pneumatic cleaners. Where it is found necessary or desirable to use Reels consideration should be given to minimize or eliminate the Sand Reel and use the entire Reel capacity as a Boll Reel so as to use smaller perforations. This conclusion is based on the fact that ample pneumatic cleaner capacity will remove better than 90% of the fine trash and greater screening area is required for removing sticks and large trash.

C. One of the most conclusive, and encouraging, experiments was in connection with the double decking of the Bauer Pneumatic Cleaners. By doubling the screening area of this machine the stick and large trash percentage removal is increased by at least 30% and in some cases better than 50%. It is believed that any mill may greatly improve their cleaning efficiency by making this alteration.

D. The application of the "Ro-Ball" principal on the lower deck of the pneumatic cleaner is very helpful in preventing the screen from clogging and thereby increases the cleaning efficiency in removing fine trash.

E. It is recommended that consideration be given to the use of basket cleaners both after the Bauer Cleaner and after first cut linters and that further study be given auxiliary devices of this kind.

F. Manufacturers of grain cleaning machinery have not shown any great interest in this problem of cleaning cottonseed and it is recommended that we continue to contact people like Hart Carter, Ro-Ball, Syntron, and of course Carnes, etc., and attempt to interest them in the problem.

G. It is believed that Mr. Gastrock's idea for breaking down the seed cleaning operation into three or more phases, rather than attempting to do a complete separation in one or two stages as we now do, is one of the most constructive ideas advanced so far. Segregating certain fractions of the seed that might be well cleaned and then re-treating the balance of the load, and passing a small fraction of the seed along with the trash for re-treatment, and various combinations of the above, appear to have considerable merit. Plans are now under way for making experiments with this theory in West Texas and it is urged and recommended that others make similar tests and, if possible, experiments be made by Mr. Gastrock in this laboratory.

Discussion

Question: What was the cost of converting the standard Bauer seed cleaner to the double-deck modification?

Answer: For 7 machines about $10,000.

Question: You could probably do the job over for less?

Answer: Probably could. Bauer should consider putting the modified model on the market.

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The Memorandum from M. C. Verdery, Chairman, to the members of the Sub-committee on Seed Cleaning follows:

MEMORANDUM NO. 2

GENERAL DISCUSSION AND POSSIBLE IMPROVEMENTS TO EXISTING SEED CLEANING EQUIPMENT

Gentlemen:

The problem of improved seed cleaning has confronted the cottonseed industry for many years but so far no appreciable progress has been made and few, if any, new ideas have been advanced.

The trend in recent years has been toward using a greater capacity of Pneumatic Cleaners and eliminating the sand and boll reel, although many operators in the Mississippi Valley still advocate and continue to use both. Very likely the boll reel would show up to a better advantage on high moisture seed where stringy grabbots would tend to clog the perforations on the top tray of a Pneumatic Cleaner. On dry seed, with ample Pneumatic Cleaner capacity, i.e., 50 to 60 tons per machine, a boll reel is not usually considered necessary.

Most mills that have been unsuccessful in eliminating boll reels have probably not had sufficient Pneumatic Cleaner capacity. For example, many mills have handled up to 160 tons of seed per day with a boll reel and two Pneumatic Cleaners and done a fair job of cleaning but definitely could not get by on the two cleaners alone. With three or four cleaners they might have successfully eliminated the reels.

A mill in West Texas that crushes approximately 180 tons per day was equipped with three combination sand and boll reels and two Pneumatic Cleaners. They were unable to do a good job of cleaning without the reels. This year they have installed two additional Pneumatic Cleaners giving them a total of four (45 tons each). At this relatively light loading per machine they should be able to do a good job of cleaning but the reels will be available if needed, and experiments will be conducted with and without the reels to determine the effect on cleanliness with various percentages of trash in seed. It is believed that some very valuable and accurate data will be obtained from these tests.

The results of a large number of tests on Pneumatic Cleaners in West Texas and analyses of the seed before and after cleaning, to determine the "Percentage of Removal", as covered by our Memorandum No. 1, reveals some interesting and startling information. With Pneumatic Cleaners handling from 50 to 60 tons of seed per day and foreign matter in seed "ranging from 1-1/2% to 2-1/2%, the percentage of removal" ranged from 40% to 50%. In no case were the cleaners removing much over half the total foreign matter. The balance of the trash was going on to the linters and contaminating the lint. A further breakdown of the trash removed indicated that in most cases the cleaners were removing up to 90% of the sand and fine trash and the low average percentage of removal was due to the fact that only 18% to 24% of the sticks and large trash was being removed. It was obvious that the sticks and large trash are difficult, if not impossible, to remove with existing equipment and of course it is a well-known fact that this large trash going to the linters is resulting in the shale and other foreign matter contaminating the lint.

On hand picked cotton, where the seed contain a small percentage of sticks and large trash, a Pneumatic Cleaner will do a reasonably good job of cleaning but the top tray, even with minimum size perforations, simply does not remove but a small percentage of the sticks and large trash. A boll reel, or scalping shaker, ahead of the Pneumatic Cleaners will do some good but whether it is sufficient to justify the additional investment and operating cost is problematical. Further tests should be conducted to determine exactly what percentage of sticks and large trash can be removed by reels and scalping shakers.

On the original installation at a mill in Las Cruces, New Mexico, handling approximately 100 tons of seed per day, an extra Pneumatic Cleaner was installed as a scalper, and operated in series with two additional Pneumatic Cleaners. With this arrangement it was necessary to clothe the top tray of the scalping machine with extremely large perforations and although it did remove considerable trash ahead of the two remaining machines, the overall results were not at all satisfactory. Later on the system was rearranged and the three machines operated in parallel. In this manner it was possible to clothe the top trays with smaller perforations and the cleaning efficiency was much better than with the original arrangement. In other workds, a single cleaning of the seed with lighter loads on each machine gave better results than double cleaning with the machines heavily loaded.

The shakers on one of the Bauer cleaners at Lubbock were altered to give two top decks and two lower decks, thus doubling the screening surface. Scott and Fichter reported July 5, 1952, on a series of twelve tests comparing this altered cleaner with a standard cleaner. Average results for the twelve tests are given below.

	% Trash Removal		Gain in Efficiency
	Altered	Standard	for Altered Cleaner
Sticks	37.6	23.3	61.4%
Other Trash	48.5	18.5	162.1
Total	62.3	44.2	41.0

On basis of the above improvement the remaining cleaners at Lubbock have been altered to give the additional screening area.

Brawner and Nisbet made small scale tests with top deck screens having ribs to make the sticks travel lengthwise and with flanged perforations to prevent sticks falling through with the seed. It is understood that similar special screens have been used successfully in connection with peanut cleaners and it is hoped that this principle may be applied to cottonseed for removing sticks. For the bottom deck a screen was made of 3/16" square key stock placed lengthwise on the deck with the edges up to form troughs. These troughs would cause the sticks to travel lengthwise and the bars were set 1/8" to 5/32" apart to allow the sticks to fall through with the small trash but to retain the seed. Similar slotted perforations have been designed from round bars and patented wire mesh construction and it is believed that this procedure might be perfected to remove some small sticks which work through the top screen with the seed.

Quite a few experiments are now being conducted using the Ro-Ball principle of rubber balls suspended under the lower deck screen of the Pneumatic Cleaners. This had definite promise in that it keeps the screen clean at all times and prevents clogging with small seed and meats. Several companies are now working on a practical design for applying this Ro-Ball principle to existing equipment.

The purpose of the above general discussion is to bring out all possible ideas for improving existing equipment and to suggest that further experiments might be conducted along these lines. I would like for all of the committee members to submit comments and suggestions to elaborate on the above general discussion and if you do not have any further ideas to suggest, please advise promptly so that this report may be forwarded into the Chairman of the committee.

I would also like to suggest that each member of the committee arrange to make analyses of the seed before and after cleaning to determine the Percentage of Removal (as outlined in our Memorandum No. 1) under various operating conditions. It is believed that if we could obtain test data from a total of 30 or 40 mills with various types and combinations of seed cleaning equipment we might be able to develop some information that would be of value. We could than make a careful study of the mills getting the most efficient cleaning results, i.e., highest Percentage of Recovery, and from this data determine the most efficient arrangement and usage of seed cleaning equipment.

In reporting on the proposed tests you should submit the following information:

A. Analyses of seed which will include percentage of trash before and after cleaning to determine Percentage of Removal.

B. Number of reels and complete specifications such as size, speed, perforated metal, etc.

C. Number pneumatic cleaners and complete specifications such as speed, size of perforated metal on each tray, etc.

In future reports I think we should go into the question of completely new machines and procedures and entirely different ideas for approaching the problem.

I will appreciate hearing from all of you promptly and I might mention that as of this date I have only had two replies to my Memorandum No. 1.

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DEVELOPMENTS IN COTTONSEED CLEANING IN TEXAS

By
Dick Taylor
Southland Cotton Oil Company

After reading Mr. Gastrock's advance copy of Cleaning of Cottonseed and Linters, there is not much left to say. His coverage on the subject is very complete; he discusses several schemes which the speaker is not familiar with except from hearsay-some of them sound very good. Cleaning cottonseed and linters are so closely coupled, it is not practical to discuss one without bringing the other in on the discussion.

I have had several years experience in the manufacture of linters. My experience has been with one concern, the geographical location of the plants owned by this concern has been such that the stick problem has not given us too much trouble. Our seed cleaning equipment consists entirely of Bauer #199 units-two units to the plant, and our plants work from 100 to 140 tons per day. I say entirely Bauer cleaners, I wish to make an exception to this statement and say that at two or three locations, we do have a nest of screw conveyors running over perforated metal to remove sand, dirt, and some small trash.

The mechanical gathering of cotton is rapidly eliminating the advantage our chain of mills has had and we are more and more faced with the proposition of sticks. And, we do have some ideas on stick removal; however, we have not had an opportunity to give them a try and we hesitate to discuss a problem of such great importance without having made an effort to correct the problem.

My opinion is that saw filing plays a very important part in the quality of lint produced. A needle pointed tooth will remove less bark from a stick than point will which is the width of the thickness of the saw. On the West Texas seed we have worked we have found this to be true.

We all know that a linter is the best seed cleaner we have up to this time. There is latitude for adjustments on a first cut linter in moting, etc., which allows for making a good product from trashy seed. Trash in the first cut lint is not so objectionable as it is not used for chemical purposes. A first cut linter will dissolve sticks, burrs and heavy trash, most of which can be moted out, then a fairly simple cleaning operation between first and second cut linters will remove more objectionable foreign matter than can be removed any other way.

We have one location where we are cleaning seed between third and fourth cut linters, this cleaner in actual operation is removing fifteen tons of black seed, meats and hulls, stick particles, leaf trash, etc., in 24 hours. This mill is working 140 tons of seed per diem. The seed going to the fourth cut linters are clean, and as most of the black seed have been removed, the lint produced on the fourth cut linters is equal in quality to third cut. Aside from the advantage gained in cleaning, considerable tonnage advantage accrues. 28-141 saw linters are installed in the lint room - seven on each of the four cuts, the plant has averaged working 140 tons of seed per day, has produced 242 pounds of lint and motes per ton, has left 2% of lint on the seed and the average cellulose for the season is 77%.

Of course, all seed cleaning operations should begin at the gin.

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"USE OF AIR SEPARATORS"

By
Allen Smith
Perkins Oil Company

This paper, as you see from our program, has to do with air separators. Air separators and electricity to me are similar in many respects. You remember the story of the student who knew what electricity was until he was asked by his professor to define it. Your speaker is in the same category. We know some of the things electricity will and will not do. The same is true of air separators.

Last Summer, following our first cottonseed processing clinic here at Southern Regional, Mr. Wallace, in co-operation with our mill superintendent, Mr. Caldwell, installed at our West Memphis plant four air separators. Two were placed in between our Bauer Bros. cleaner and 1st cut linters and two were placed between 1st and 2nd cut linters. They are removing a slight amount of shale, other trash and some faulty immature seed. The amount of sticks removed is nil when compared to the original content. Later in this program both Mr. Wallace and your speaker will have further discussion regarding the air separator as it has to do with "Cleaning Lint."

To determine what each piece of seed cleaning equipment was doing - samples were taken after each of the following places: (A) Seed House - (B) Sand and Boll Reels - (C) Bauer Bros. Cleaners - (D) 1st Air Separators - (E) First Cut Linters - (F) 2nd Air Separators - (G) Second Cut Linters - (H) Third Cut Linters and (I) Safety Shaker. Fines, sticks and other trash were determined as outlined in the first memorandum by Mr. Verdery. The results are as follows:

	%Content				% Removed			
Samples Taken After	% Fines	% Sticks	% Other Trash	% Total F.M.	% Fines	% Sticks	% Other Trash	% Total F.M.
Seed House	0.46	0.40	0.44	1.30	-	-	-	-
Sand and Boll Reels	0.03	0.33	0.31	0.67	93.5	17.5	29.5	48.5
Bauer Bros	0.01	0.28	0.34	0.63	99.8	30.0	22.7	51.5
1st Air Separator	0.00	0.25	0.37	0.62	100.0	37.5	15.1	52.3
1st Cut Linter	0.08	0.10	0.19	0.37	82.7	75.0	56.8	71.5
2nd Air Separator	0.05	0.09	0.22	0.36	90.6	76.3	50.0	74.5
2nd Cut Linter	0.30	0.02	0.19	0.51	63.4	96.6	73.2	75.8
3rd Cut Linter	0.20	0.01	0.20	0.41	76.0	98.3	71.8	80.6
Safety Shaker	0.17	0.03	0.15	0.35	79.3	94.8	78.9	83.4

This data when put on graph paper visually stands out in your mind. The different colored lines tell the story from the seed house all the way to the hullers. The blue is for the fines. The red is for the sticks. The green is for the trash. The black line represents the combination of sticks and other trash. The colored lines at the bottom of the graph represent % content, while

the corresponding color lines at the top of graph give you the picture as to the % removed at any and all points where samples were taken.

Your speaker is of the opinion that our whole system of seed cleaning desperately needs drastic changes in design or a complete change in approach to the question of seed cleaning.

Results obtained at our Perkins plant in Memphis indicate that our sand and boll reels are doing a better job of removing sticks and other trash than our reels at West Memphis plant. At Perkins our crush of 150 tons per day is divided between two reels. The intake end of the reel has 1/8" round hole metal, the discharge end has 1/2" round hole metal. Perkins reels are removing 52% of the sticks and other trash.

West Memphis plant has a boll and sand reel - 150 tons per day pass through the boll reel having 1/2" round hole metal, then pass through the sand reel having 1/8" x 1" slotted metal - West Memphis reels remove 24% of the sticks and other trash.

Information obtained from Mr. Hassler of the Buckeye Memphis plant, states that trashy or late season seed worked this year, contained a total of 2.64% foreign matter. At the first cut linter the seed having passed through sand and boll reel and Bauer cleaner, still contained 1.53% sticks and other trash.

One more example - a spot check on seed milled at Southern Cotton Oil Company, Memphis - showed seed to contain 3.03% total foreign matter. After passing through sand and boll reel, Atlanta Utility cleaners, the total content was 1.47% or a reduction of 51.5% total. The sticks and other trash removed amounted to 41% of original content.

In conclusion, let me try and compress this report by saying - First, in your speaker's opinion, none of our present day seed cleaning equipment is doing the job that is expected or desired. Secondly - air separators under present setting and limited know-how are not removing the sticks, -- only a small amount of other trash and shale with some faulty and immature seed. However, we do know that our second-cut lint has moved in the market at a premium above current price level. Also there are other factors to consider aside from air separators when quality of second cut lint is discussed. These factors no doubt will be mentioned by Mr. Wallace just a bit later in this program.

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RECENT DEVELOPMENTS AND EXPERIENCE IN CLEANING COTTONSEED

PART I

By
M. D. Woodruff *
Bauer Bros Company

The problem of introducing clean seed to the linters starts in the cotton field but these comments will be limited to the oil mill proper, while recognizing that the problem as a whole can be aided by improvements in cotton pickers and gins.

Industrial progress generally results from the accumulative effect of small improvements. Occasionally, an industry benefits from a spectacular piece of equipment or a new process, but this is the exception rather than the rule. In the past twenty years, the speed of a paper machine has doubled, yet its fundamental principles remain unchanged. It is essential to this step by step progress to be able to measure the performance of the equipment, as usually this type of progress consists of two steps forward while slipping back one.

Shortly after the war, we engaged in an extensive co-operative development program with Buckeye Cotton Oil Co. One phase of this program was improvement in cleaning cottonseed. Recognizing the necessity for a means of measuring the dirt in cottonseed, we spent some time in an attempt to develop a reliable method. This consisted of sampling the seed, screening the sample to remove fine dirt and hand picking the remainder. Being unable to duplicate results with this method, it was abandoned. The method finally selected was to weigh each dirt fraction coming from the cleaner. Knowing the weight of seed processed, we calculated the percent of dirt removal and using this method compared various modifications in the cleaner. The obvious fallacy was the assumption that seed coming to the cleaner had a uniform dirt content. Another weakness was the failure to identify the character of dirt which was removed. It is much easier to take out a pound of sand than a pound of sticks.

The business of the Bauer Bros Co., is basically the building of grinding and separating machines for the vegetable oil, pulp and paper, chemical and food industries. Methods learned in one industry can often be profitably employed in another. The pulp and paper industry has a dirt problem very similar to yours in that both industries are using natural raw materials which are subject to all the vagaries of nature. They too are receiving dirtier raw material due to high labor costs. To evaluate the effectiveness of cleaning devices, they employ the following method.

One particular mill is testing four different centrifugal pulp cleaners and the arrangement is such that 14 samples are required. A technically trained man draws a sample of pulp and from this makes four sheets of paper about 8" in diameter and of equal weight. A code number is assigned each sheet and the dirt appearing on the surface is counted by three girls, successively, thus giving twelve values to the original sample. The average of the twelve vales is considered the dirt count of that sample. The dirt count is made by comparing a

*Presented by W. C. Cantrell

dirt speck in the sheet with dirt specks of various geometrical shapes on a master sheet and the number assigned the dirt speck in the sample indicates the area of that speck. When desired, the character of dirt is identified, such as bark, metal scale, rotten wood, etc. Experience has taught that 50 samples are indicative and that 200 samples are required to be conclusive. We at Bauer Bros failed to find a way to measure dirt in cottonseed because we were not conditioned to the enormous amount of work required. Apparently, the only way to overcome sampling error is by taking so many samples that the errors cancel out. Obviously, if you sampled every portion of a ton of cottonseed, you would have an accurate figure on the dirt content.

Another company has completed a study of two different methods of removing dirt and in making this comparison 850 samples from each method was evaluated. The average of these samples showed the new system to remove five times as much dirt as the old which is a significant difference, yet on twenty different occasions the samples showed the new method to be inferior. To measure small improvements, it is obvious that an accurate sampling and evaluation method must be employed.

In the writer's opinion, a sampling method should report all dirt and be capable of identifying various kinds. The method would be satisfactory for evaluating seed cleaning if it reported within 5% of the actual dirt content of the seed. It is our opinion that the Southern Regional Research Laboratory is the type of institution that can best establish a sampling evaluation procedure and we hope that they will undertake such a project. Even though the method proves to be as laborious as that used in the pulp and paper industry, we would recommend its adoption by the oil mill industry and that industry would have to condition itself to such a lengthy and costly procedure if it wished to evaluate seed cleaners.

Seed cleaning employs the following principles of separation:

1. Sizing by screens
2. Pneumatic separation
3. Specific Gravity separation
4. Magnetic separation

Assume that a shaker five feed wide and ten feet long is clothed with 5/32" x 2" herringbone and that a layer of perfectly clean cottonseed is passing over it. Now add to the seed at the feed end a stick which is small enough to pass through the perforations. Sometime during its travel it must work its way to the screen surface and the axis of the stick must align itself with the long axis of the slot so that gravity can pull it through - otherwise it discharges with the cottonseed. It is evident that separation by screens is a matter of probability, so that if ten sticks are placed on the seed, possibly seven will go through.

Pneumatic separation also follows a rule of probability on any shape other than substantially spherical. Consider a piece of boll lining the size of a nickel. We place it in an air current with the broad surface facing the air

stream and the force of air against it is sufficient to readily lift it. However, should the edge be toward the air stream, the lifting effect is slight. In addition to the frontal area of a particle, another factor influencing separation is interference with the cottonseed. The light piece may start to move with the air current when it is bumped into by a cottonseed and forced to travel in the latter's direction. In the fan hood of a cleaner the seed is thrown horizontally across a stream of air and in from 1/20 to 1/30 of a second we attempt to separate irregularly shaped, light weight particles from seed. Obviously the rule of probability applies to this type of separation.

Specific gravity separation can only be applied successfully to the separation of bald seed and rocks as woolly seed tends to felt and travel as a blanket on a specific gravity deck. Here again the rule of probability applies as the frontal area of a bald seed varies considerably depending on whether its long axis or its short axis is across the air current.

Magnetic separation is the most positive of the methods employed and as it is generally satisfactory, no further discussion of it will be made.

While seed cleaning is limited by the rule of probability, we can still make use of the fact. First find the optimum capacity for cleaner operation and install sufficient machines to operate at about this capacity. If under these conditions a certain piece of equipment is 70% efficient and if seed is passed through two such units in series, the first will remove 70% and the second will remove 70% of the remaining 30% or 21% so the combined cleaning is now 91% efficient. Therefore, it is advisable to operate shakers in series with the main cleaners and to further supplement them by such devices as perforated bottom conveyors, and beaters in the seed discharge of the 199 Cleaners and in first cut linters. In other words, avail yourselves of every opportunity to remove some dirt from cottonseed as no known method can yield perfect results.

Embedded andentangled dirt adds to the difficulties of cleaning. Another virtue of series operation is that mechanical handling will free dirt as the seed is transported from one piece of equipment to another. First cut linters are excellent agitators and shakers operating on seed from them will be able to remove dirt that was entangled in the lint during the first cleaning. It is our opinion that a series shaker with the entire twenty feet equipped with self-cleaning ball sash, placed between first and second cut linters, will remove a substantial quantity of sticks and boll fragments.

I have been advocating more cleaning equipment as a solution to the problem and to show that we are not going to extremes we will again make a comparison with the paper industry. It requires about 7 sq. ft. of screen plates to screen one ton of wood pulp in 24 hours. On this basis a 199 cleaner would handle a little over seven tons per day.

The more seed is handled and cleaned, the greater will be the loss of lint with the dirt. It also is true that if the pneumatic separator is set to pull hard that some immature seed will be removed with the dirt. When these losses become excessive reclamation means will have to be employed to retrieve saleable products and such means are feasible. The operating personnel will have to condition themselves to the use of more machinery than formerly, cleaners in

unaccustomed locations, and minor equipment to recover the commercially useful products from the dirt.

While we should ever be alert to the development and application of radically new methods, yet success is still 90% perspiration and the people who patiently progress by modifying and improving the old methods have been rewarded. Some of these improvements will now be described by Mr. M. E. Ginaven.

PART 2

By
M. E. Ginaven
Bauer Bros Company

It is the policy of The Bauer Bros Company to incorporate improvements in its products immediately after the completion of satisfactory laboratory or field tests. Following this procedure, we have constantly improved the functions; simplified the construction and reduced the maintenance on our No. 199 Cottonseed Cleaners. The 1953 model No. 199 is certainly a proven device, capable of doing a better job of cleaning cottonseed than any piece of machinery developed to this date.

Even though our Company is 75 years old this month and we enjoy a world-wide reputation as manufacturers and engineers, we have never built a single piece of machinery that pleased every operator, or universally met all processing needs. Admittedly, the No. 199 Cleaner for cottonseed has limitations in capacity and efficiency and despite the expenditure of over $60,000, since 1945, only three or four major improvements and perhaps 25 minor changes have been found feasible for commercial use.

Among the minor changes made, we can list 6 of general interest to most operators.

1. Redesigned feeder for more uniform delivery of seed at lower rates.
2. Incorporation of a Permanent Magnetic Separator under the feeder.
3. Elimination of inlet feed roll.
4. Completely redesigned frame and fan hood.
5. Use of standard, interchangeable pillow blocks for mounting both eccentric and fan shafts.
6. New rubber mounted hangers were developed for shaker mountings.

So far as major changes are concerned, it has been our observation that the mechanical screening ability of the No. 199 Cleaners has been doubled by the use of both flanged metal screens and self-cleaning wire screens.

Flanged metal sash for the upper shaker are definitely superior to standard flat perforated sheets since they are physically much stronger and tend to remain flat. They also stay much cleaner, and certainly their ability to reject large debris, sticks, bolls, etc., is now well established.

Recently, we undertood a cooperative development program with a West Texas group of mills with the object of improving the mechanical screening ability of the lower shaker of the No. 199 Cleaner, where we normally remove small sticks, stems, black seeds, and sand. Since all screens or perforated sheets are subject to blinding to some degree, and since the mechanical screening efficiency varies inversely with the amount of effective open area, we sought to achieve three things:-

1. Provide as much open area as was feasible with rigid steel wires, or fabricated sheet steel shapes.
2. Prevent in so far as possible the natural blinding of our sash.
3. Provide a means of continuously ejecting any material that would become lodged in any opening.

By trial, and much error, we have produced a practical screen having openings of approximately 1/8 inches by 2-3/4 inches. At the moment, we are in the process of making welding tools and fixtures for this lighter weight, more durable assembly, designed as a weldment of formed wires. We expect to be in production on these new sash in about 45 days.

The Simmons Cotton Oil Mills, who have equipped their Cleaners with self-cleaning sand and stick sash, indicate that they will remove approximately twice the amount of small sticks as compared with the normal removal by standard perforated metal sash. Sand is also more readily eliminated from the seed.

One large user of Bauer No. 199 Cleaners, the Plains Cooperative Oil Mill, has developed a means of obtaining additional screening area for small sticks and trash removal, by incorporating a small beater roll which works in close clearance with a sheet of perforated metal similar to that used on sand and stick screens. This unique design increases the dwell-time of the sticks on the screen area and in effect increases both the time and screen area factors of screening. Our observations concerning this device are limited to preliminary data which indicates that each unit will remove about 192 pounds of sticks and other small trash from 160,000 pounds of seed per day. This amounts to an added 0.1% of cleaning ability above our normal 1 to 9 percent total removal with standard cleaner equipment. The Plains Cooperative Oil Mill is currently planning to substitute about nine of their devices in series instead of using the lower shaker for the removal of small sticks and dirt. This experiment should reveal some interesting information.

Using the dirt analysis method established by the Seed Cleaning Committee, the trash from the beater attachment fractionates as follows:-

Fines	-	40.6%
Sticks	-	14.3%
Other Trash	-	45.1%

It is interesting to note that the fines consisted of very small stem and boll fragments and practically no sand, indicating that the shakers of the cleaners are doing a fairly complete job of fine dirt removal.

Incidentally, the Plains Cooperative Oil Mill has issued an invitation to interested parties to visit their mill in Lubbock.

There has been little or no criticism relative to the functioning of the pneumatic section of our cottonseed cleaners, although about three years ago we did modify the interior to permit greater expansion of the air below the intakes to the exhauster. This feature was adopted as a direct result of the studies made by Mr. Verdery of The Anderson Clayton Company, and this modification is recommended for mills likely to encounter light weight seeds.

We, at Bauer Bros Company, are sincerely interested in meeting the requirements of the cottonseed industry for improved machinery to meet new, or changing conditions. Admittedly, we are somewhat deliberate in all our investigations, but the apparent slowness with which many development projects move, is in most cases off-set, by the satisfactory, and economical operation of the final products.

Our line of hulling, separating, hull beating, hull delinting, and meal grinding machinery is entirely new since the war, and while we have retained the machine number, 199, since 1930, there is little in common with today's equipment and the original seed cleaners.

General Discussion

F. M. Wells, Chairman, requested that anyone having ideas on solution of the problems present them.

Smith: Mr. Verdery, why did you remove your sand and boll reels?

Verdery: I just don't like boll reels. They take up lots of room and are not needed if pneumatic cleaners are used. On the basis of our tests at Abilene we found the reels were doing very little if any cleaning. I believe that elimination of boll reels actually results in a better cleaning job where pneumatic cleaning is used.

Loggins: Could you do the same work by adding another cleaner instead of double decking?

Verdery: No. One additional standard machine increases capacity only 50% whereas double decking two existing machines would give you 100% increase in capacity. Besides double decking is cheaper.

Unknown: Will any machine now on the market remove 100% of trash?

Verdery: No. Our problem is one of doing a better job with what equipment is presently available. A 30% improvement by making the best use of existing machines is a step in the right direction. We certainly are not standing still.

Unknown: Mr. Smith, did I understand you to say that after 100% removal of fines some were put back?

Smith: No. The sand and boll reels took out 94%. The Bauer 3% more. The first air separator brought the total up to 100% trash removal. In subsequent delintering some seed were cut and some sticks chewed up by the saws. This stuff

analyzed as fines in the final lint.

Ginaven: I wish to point out that differences in the age of the equipment used has a bearing on the results obtained. Many of the machines in use today are 20 years old and cannot be expected to do as good work as newer machines.

Martak: How many tons of seed per day are put through a Bauer Bros cleaner?

Verdery: About 50 tons per machine for the standard Bauer Bros cleaner. If double decked the capacity is increased to 65 or 75 tons if 1/2 in. perforated metal is used for the top screen. As the moisture content of the seed goes up the capacity may drop to 40 tons.

Stokes: If the cotton is well cleaned at the gin before ginning does the farmer get more for his lint and seed? It seems to work out pretty well in the few cases we have tried; i.e., it appears to be a paying proposition for the ginner to preclean cotton.

Verdery: It all depends on the locality and the trading practices prevailing locally. Some ginners return the trash to the seed while others deliver clean seed by emptying trash from the seed rolls.

Woodruff: Ginners could do better in many cases though some do a good job of seed cleaning.

Rogers: All seed as it comes from the gin are clean. Contamination comes from using the same equipment as is used for bringing in cotton to be ginned to deliver the seed to trucks or the seed house. Proper gin construction could eliminate this problem.

Woodruff: We recognize that seed cleaning is an oil mill problem but some work to improve it could be done at the gins.

Rogers: Buckeye Cotton Oil Company. Any chemical which would dissolve the sticks would dissolve the lint first. I am glad that this cleaning work is now going on. I have been advocating it for years. Now that the competition from wood pulp is real we have to keep pace.

Statement by Dr. Burt Johnson
National Cotton Council of America

The Cotton Council would like to help the ginners and oil mill operators. If you will let us know your problem definitely we can do some work with the ginners. Oil mills paying by grade would encourage cleaning by ginners. The appeal must be financial. The ginners must be educated. In our organization we have men who are pretty good at doing that.

Stoneville is working on this problem.

Sticks taken out by the overhead cleaners can be kept out of the seed. Sticks in the seed rolls go back into the seed. Sticks reaching the linter saws cause most of the problem. Construction of gins makes avoidance of seed roll

sticks going back in the seed stream impossible. Prices of seed are set up with a 1% allowance for trash. Ginners are bound to take advantage of this setup.

Cleaning is a more difficult problem than it was in the past because of more machine harvesting. When a precise statement of your problem is made we will try to begin work.

Woodruff: You might say that we ourselves have been stumbling around trying to understand our problems a little better. Conferences of this type are certainly a help and are in the right direction.

SUBCOMMITTEE REPORT PREFACING PORTION OF PROGRAM DEVOTED TO DISCUSSION OF DEVELOPMENTS IN LINT CLEANING

F. M. Wells, Chairman
Buckeye Cotton Oil Company

Without going into any detailed discussion at the beginning of this afternoon's program, let us try to define in a general way just what place improved lint cleaning has in the overall problem being discussed today.

To establish a line of thinking, let us assume that at any one time we will be processing either (1) good, clean seed, (2) trashy seed but with satisfactory and effective cleaning equipment, or (3) trashy seed without cleaning equipment. Of course, these three catagories do cover all possibilities in a very general way only.

Excepting some parts of the West, we have had, for the most part until the last two seasons, good, clean seed to process and a satisfactory market on which to dispose of lint. Under such conditions, we cut and cleaned lint with no more concern than was caused by an occasional discount when cellulose was low; and except with very dry seed of this type, we had little trouble keeping shale count or trash content down to a satisfactory point. Even when cellulose was low, the yield of lint per ton of seed would normally be higher; and with a good market, we would about break even with prime grade. The problem now with the portion of good seed received is to cut really good lint and thereby improve our chances of trading off a little bad lint later on. These good seed also have to be put to other good uses such as for blending with trashy seed to up grade lint from this portion of our receipts. At many mills, this has been the only way in which a salable lint could be cut from trashy seed.

We need only to touch on the second condition of processing trashy seed with adequate cleaning equipment; if, when or where such conditions exist, one should be able to produce a lint of quality equal to that cut from good seed. However, if cleaning equipment is complicated by the use of several pieces of separating equipment, a complete study of the disposition of the various cleaning fractions must be made in order to prevent valuable meats and fiber fractions from being discarded.

The last condition, that of processing trashy seed without satisfactory cleaning equipment, is, of course, the reason that we are present here today. Very few of us would need to change our lint cutting and cleaning system if we

could clean these trashy seed adequately. There is no question that the consensus of those confronted with this problem is that given clean seed they could cut and bale good lint. All of us have some ideas on how to improve seed cleaning; and from the discussions of the morning, we know that a lot of work has and is being done on this problem. However, a complete solution providing uniform and economical application at all mills have not been found. Because of this, new lint cleaning developments have a unique position in this cooperative work to produce better lint. Any statements to the effect that given sufficiently good lint cleaning equipment we would not need to clean seed has, to say the least, little practical foundation. Such a condition is also practically inconceivable. However, there are certain ways which good lint cleaning equipment can ease the solution to our problems. Probably the most important is that improved lint cleaning equipment can or might provide temporary relief in lieu of improvements in seed cleaning. This might well be brought about by not knowing what to install in the way of new seed cleaning equipment. In the discussion this afternoon quantitative data will be given which indicate that new lint cleaning equipment for such application may be available now.

We want to emphasize again that the main purpose of improving lint cleaning to produce a satisfactory lint from trashy seed should be only as a matter of expediency and certainly at present cannot be considered a permanent solution to the trashy seed problem. The main pay-off for cleaning seed instead of lint, is the reduced lint loss which results when the amount of material cleaned from lint is reduced. Let us summarize then by saying that improved equipment and processing methods for lint cleaning are important; first, as applied in lieu of seed cleaning because of not knowing what to install; or second, to improve the quality of lint cut from dry or fragile seed; and third, should it prove economical to do so, to produce lint of extra quality from good seed.

Our program this afternoon has purposely omitted any detailed discussions on the use of beaters for cleaning lint. Even though beaters probably will never become obsolete in lint cleaning, a discussion of beater use and operation would not be an economical use of time here.

First, this afternoon, Mr. Lucien Cole of Industrial Machinery Company will bring us up-to-date on the latest developments in his work on centrifugal separators for removal of large foreign material particles from lint. Those of you who already have this equipment should be ready to give us the benefit of your experience as soon as Mr. Cole has completed his preliminary talk.

DEVELOPMENTS IN CENTRIFUGAL SEPARATORS

By
Lucian Cole
Industrial Machinery Company

When we first started lint cleaning, it wasn't much of a job. There has been a lot of time and effort given to lint cleaning, and considerable progress has been made. However, the big job is to improve the cleaning fast enough to keep up with the contamination, or the job the cleaners are expected to do. Practically all of our Texas cotton is mechanically harvested. Combine that with a very dry year, and you find yourself trying to get seed out of sticks and trash,

rather than to get sticks and trash out of seed. So it may be our best lint cleaner is a good seed cleaner.

My experience in cleaning lint has brought me to the conclusion that it takes the combination of beating and pneumatic separation to do the job. It is my opinion that we have been going at the job the hard way. That is, our present beaters are clothed with 1/8" x 1" slotted metal, which only removes a part of the small shale and pepper. Then a type of moting that only gets some of the seed and heavy hulls. The refuse is partially cleaned, and recycled back to the beater again. Recycling in this way I think, is about enough within itself to defeat our purpose.

The cleaning job, in my opinion, will be much easier done if we will clothe the beater with large enough perforations (probably 3/8" round hole) to allow all trash and sticks to go through, and 75 to 80% of the lint to pass over this screen and out of the beater reasonably clean. From the beater, pass through a pneumatic cleaner on its way to the bale press. The refuse from the top pass of beater goes thorugh enough pepper and shale beater to do most of the cleaning. Then passes through the pneumatic cleaner to bale press to be blended with lint from top section of beater.

The pneumatic cleaner will remove foreign materials that is impossible to beat out, such as limb bark, fine pieces of splintered stalk, or limb stick and the white pulp or shale. The cleaner is designed with two air chambers. The lint travels through the inner chamber by suction, in a circular movement, as it passes through the cleaner, which causes material heavier than lint to sling out against the wall of the inner chamber. This wall has orifices of proper size and location to jet out the foreign materials into the outer chamber. The air inlets for the outer chamber are so designed to cause a circular movement of air in the outer chamber similar to the action in the inner chamber. As the foreign materials are jetted through the orifice into the outer chamber, it is held against the outer wall to prevent it being sucked back through the orifices with the lint again.

The pneumatic cleaners do their best work with as low vacuum as you can have. That is, it is not advisable to attempt to suck the lint long distances to the cleaner, causing a high vacuum through your cleaner. Best results are obtained where lint is dropped into cleaner from collector. If lint is to be picked up from beater to cleaner, pipe size and velocity of air are important.

The trash and shale is removed from pneumatic cleaner by small conveyor discharging through a plug, to seal off air.

We are now building new machines for research work on both seed and lint cleaning. Some of these machines will be ready for testing within the very near future.

Discussion

Bremer: How near ready is this centrifugal separator for commercial use?

Verdery: They are now on the market.

Bremer: I have been led to believe that more experimentation was required before the machine would be ready.

Cole: It was a question of capacity at the time. We are now ready, I think, to meet any size demands. I am now the sole owner of the company and I can guarantee a much better company policy. The information you received was given out during the management change.

PNEUMATIC LINT CLEANING

By
M. C. Verdery
Anderson Clayton and Company

This report will deal primarily with pneumatic lint cleaners and similar devices for treating lint before and after lint beaters. Most of these tests were made at the Western Cottonoil Company at Lubbock which crushes approximately 450 tons of seed per day, cuts approximately 124 pounds of lint from seed that average approximately 8% total lint. The mill is equipped with 72 Carver 176-saw linters with 18 linters each on first, second, third and fourth cuts.

Last year one Industrial Pneumatic Cleaner was installed to handle all of the fourth cut lint from the robber line ahead of the beater. With this arrangement the cleaner was handling all of the lint from 18 fourth cut linters plus some recycled material from the second and third cut beaters and it was estimated to be handling approximately 750 pounds of lint per hour or 18,000 pounds per day. This pneumatic device removed considerable fine trash, shale, etc., and greatly relieved the total load of foreign matter in the lint going to the beaters. Unfortunately, most of the material removed by this device would normally be removed by the lint beater and only a slight improvement in the finished product was noted.

The Lummus Super Jet Pneumatic Cleaner was installed in parallel with this Industrial Cleaner and valves installed so that the load of lint could be diverted from one to the other so that accurate comparative tests could be made between the two pieces of equipment. An extensive series of tests indicated very little difference, if any, between the two machines.

Later on, the Super Jet Cleaner was installed after the beaters to handle the entire production of second, third and fourth cut lint which amounted to approximately 54,000 pounds of lint per 24 hours. With an arrangement of this kind there is no question but that any foreign matter removed would improve the quality of the lint accordingly as it would otherwise go directly to the baling press. This pneumatic cleaner working on the finished lint removes anywhere from 2 to 4 pounds of trash per bale of lint and it is believed to be very helpful in improving the quality of chemical linters.

A further test was made in which the finished lint from the Super Jet Cleaner was passed through an Industrial Cleaner but by this time there was such a very small percentage of foreign matter left in the lint it would not take out sufficient trash to justify its operation.

In order to determine just what we were confronted with, a series of 1/2-pound second cut lint samples of acceptable quality were hand picked and found to contain anywhere from .20% to .38% foreign matter. This lint was acceptable to the chemical trade and we would say is better than average West Texas second cut lint. It had already passed through the above mentioned series of pneumatic cleaners and, obviously, the difference between what we are now producing and what it will take to make the lint perfectly clean will range somewhere between 1 and 2 pounds of very fine trash per bale of lint. There was absolutely no large trash particles in the samples and it consisted altogether of very small shale particles and broken stick fibers.

In order to get the final answer to the pneumatic lint cleaning problem the Lubbock mill was equipped with whirligigs on all lint flue collectors, moting slots (of our own design) on the second and third cut linters, pneumatic cleaners on the second, third and fourth cut robber lines, a pneumatic cleaner for the "recycled lint" and a Super Jet Pneumatic Cleaner on the finished lint. Analysis of the trash removed by all of these devices is tabulated below:

TRASH REMOVED FROM LINT BY PNEUMATIC CLEANERS AND AUXILIARY DEVICES FROM WEST TEXAS SEED

	#/24 Hrs.	#/Ton Seed	#/Bale (600) Lint
1st Cut "Whirligigs"	140	.31	1.5
2nd " "	5	---	---
3rd " "	6	---	---
4th " "	7	---	---
3rd Cut Moting Slots	1378	3.1	14.5
4th " " "	773	1.7	8.2
2nd Cut Pneumatic Cleaner (Ind.)	360	.8	3.8
3rd " " " "	490	1.1	5.2
4th " " " "	605	1.3	6.4
Reclaim Lint--Pneumatic Cleaner (Ind.)	1380	3.1	14.6
Finished Lint (2nd, 3rd and 4th)Pneu.Cl. (Super Jet)	270	.6	2.9
TOTAL -	5414	12.01	57.10

It is significant from the above data that the moting slots on the third and fourth cut linters are removing more trash than the pneumatic cleaners, which would indicate that any mills not equipped with such devices should give them serious consideration.

It is also significant that the pneumatic cleaner handling the reclaimed or recycled lint is removing a large percentage of trash which, in this case, is very important as the reclaimed material is being recycled back to the fourth cut beater.

The pneumatic cleaner handling the finished lint is not removing a large volume of trash but is taking out better than half of the foreign matter left in the lint at that point and if large foreign matter such as hull particles had not already been removed it would make an even better showing. It is believed

that the pneumatic cleaner after the lint beaters is of more value than before the lint beaters.

It is concluded from this experience at Lubbock, where more pneumatic lint cleaning equipment was installed than would be practical in most mills, that pneumatic cleaning is not the final answer to making the best quality lint, although it is helpful and in order to accomplish the desired results we must make drastic improvements in seed cleaning.

A description of the 'Whirligig'

By
Redding Sims
National Blow Pipe and Manufacturing Company

What we have chosen to call the 'Whirligig', because the name is more or less descriptive, and happens to be a perfectly good English word, can be briefly described as follows.

Four 90 degree elbows are fastened together, to make a continuous turn of 360 degrees. These elbows are made of rectangular section, so that as the air stream inside of same, whirls around, the heavier particles are naturally thrown to the outer walls of the elbows and shall tend to slide along these vertical walls in a thin plane, rather than at a point as would be the case if the elbows were of circular section.

Vertical slots are cut in these outer walls, and a piece of piano hinge is welded to that edge of slot or louvre, on opposite side of the 'gap' over which the material is passing. The loose edge of this piano hinge is pushed into interior of elbow at an angle and adjusting screws permit them being set at varying angles, and the aperture of the slots being increased or decreased.

As any heavy material thrown to the outer wall, and traveling along same, reaches one of the louvres, the edge of the hinge projecting into the elbow, will tend to deflect the material to the outside of the elbow, where it can fall by gravity.

It is quite obvious that such a device as described, must of necessity be on the suction side of the fan, for if it were blown into, everything would try to get out of the louvres.

When traveling at a sufficiently high speed, the centrifugal force of the revolving air, will tend to throw out Lint as well as heavier materials, but since there is a vacuum within the 360 degree elbow, some air will attempt to enter at each louvre or slot. This entering air will tend to, and can be adjusted so that, it shall 'suck' back the lint into the interior of 'Whirligig'.

By sealing the 360 degree elbows in a container, to collect the material thrown out, and to control the amount of air permitted to enter the 360 degrees of elbow, we can by adjusting louvres and amount of air permitted to enter, get a nice control over operations, and remove only hull particles, meats, etc., while only a minimum of lint is taken out. Of course, adjustments are necessary, and

the access doors permit this.

Since the operation of this device depends upon Centrifugal Force imparted to the material, to make it 'hug' the outer periphery of the 'Whirligig', it might be well to recall that such centrifugal force depends upon the weight of the particle, its velocity of travel, and the diameter of the path of travel. The centrifugal force increases as the square of the velocity of travel, so by doubling the velocity we have four times as much force tending to throw the material to outer walls for scalping off.

Naturally, as some air enters each slot due to suction on the inside, the volume of air within the 360 degree elbow is increased after each louvre, and more air passing through the equal area of section, means that the air travels faster and faster until it has completed the 360 degrees of travel.

We recommend placing the 'Whirligig' on the line robbing the Lint Flue cyclone and sucking just enough air from the cyclone to properly convey the material; the 'Whirligig' should be as close to the large cyclone as is possible; the stream of air being pulled through the 'Whirligig', must be regulated by speed of fan and/or blast gate or valve, to give enough velocity of travel, such valve should be between fan and 'Whirligig'. With only a minimum of air being admitted to the shell containing the 360 degrees of elbow, the travel of air, or the CFM should be such that it tends to throw out lint. By admitting more air into the shell the lint will cease to come out but the heavies will come out, of course adjustment of piano hinge louvres, as well as those just mentioned, is essential.

THE RELATIONSHIP OF FOREIGN MATTER CONTENT OF COTTONSEED TO THE AMOUNT OF EQUIPMENT USED IN GINS FOR CLEANING SEED COTTON

By
Francis L. Gerdes, In Charge
Stoneville Cotton Laboratory
Research and Testing Division

The subject assigned to me was, "Application of Seed Cotton Cleaning Equipment to Cottonseed and Linters"; but when preparing this paper, it occurred to me that a more fitting title for what I am to say would be, "The Relationship of Foreign Matter Content of Cottonseed to the Amount of Equipment Used in Gins for Cleaning Seed Cotton." This is especially true since the work of the U. S. Cotton Ginning Laboratory 1/ at Stoneville, Miss., and of the one at Mesilla Park, N, Mexico, has been concerned primarily with evaluations of the effects of ginning machinery and operating practices upon the quality of the ginned lint. Recently, we have been engaged in the development of a cottonseed drier and cleaner. Prior to this activity, the work done at Stoneville on cleaning problems had been concerned chiefly with developing and testing equipment for cleaning seed cotton harvested by different methods under a wide range of conditions with a view to obtaining improvements in the grade of the ginned lint.

1/ This laboratory is jointly operated by the Bureau of Plant Industry, Soils, and Agricultural Engineering of the Agricultural Research Administration and the Cotton Branch of the Production and Marketing Administration, U. S. Department of Agriculture.

Observations during these tests have generally indicated that machines and processes which remove sufficient foreign matter from seed cotton to significantly enhance the value of the ginned lint also aid in providing cleanly ginned cottonseed which, when processed properly in oil mills, should, in turn, yield linters of acceptable quality, except on late-harvested, weather-damaged seed. Thus, as rapidly as improved seed cotton cleaning equipment has been adopted and used by ginners there should have been a proportionate increase in higher grade linters. On the other hand, it is conceivable that certain practices in seed cotton cleaning might result in crushing and breaking of large trash particles such as sticks and stems into small troublesome ones which escaped the ginning process along with the seed.

To provide a background for further discussion of the subject, the functions of cleaning units employed in gins need to be considered. In a cotton gin the cleaning equipment may range from a separator, 4-cylinder cleaner, and extractor feeders to several separators, 20 to 30 or even more cylinders for cleaning, 2 overhead bur machines, 3 driers, and large-type double-extractor feeders, the extent of such equipment depending upon the prevailing harvesting practices. These combinations of cleaning machines may be supplemented by the newly developed lint cleaners used to clean the lint after it is separated from the cottonseed. In the processes of cleaning cotton at modern, elaborately equipped gins, the seed cotton is drawn from the wagon, truck, or trailer through a 10- to 12-inch air pipe connected with a separator fitted with a screen through which the conveying air, laden with fine trash, is exhausted. This process makes it possible for the seed cotton to be dropped through a vacuum wheel for placement in an air line. The cotton is then blown through a drying unit by heated air for the purpose of reducing the moisture content and thus facilitating the trash removal action of subsequent cleaning processes and to promote a smoother job of ginning. In an area where sand and unopened immature bolls are frequently components of the foreign matter present in the harvested cotton, air-line cleaners or hot air cleaners, fitted usually with 4 to 6, and sometimes as high as 16, cleaning cylinders, are used in the suction line ahead of the separator. The functions of the cleaner are to remove large quantities of sand and some sticks and stems from the cotton, and to open the bolls in a manner to increase the efficiency of subsequent extracting processes.

After the cotton is dried, it is blown or dropped to cylinder cleaners. The conventional cleaner is equipped with a spiked-drum or spider-type cylinder for carrying and "scrubbing" the seed cotton over wire mesh screens through which fine particles of leaf trash, dirt or sand, stems, and small sticks are expelled from the cotton. Sometimes the suction from a trash-disposal fan is connected with the trash hopper to increase the effectiveness of the cylinder cleaner. The number of cylinders in this cleaner ranges from 5 to 15. As the cotton leaves this cleaner, it is conveyed to the bur extracting machinery, the function of which is to remove burs, immature bolls, sticks and stems, as well as fine particles of trash, such as those removed by cylinder cleaners. In moderate-capacity gins, one bur machine, about 10 to 14 feet in length, is used, while in high-capacity, 4- to 6-stand gin plants, the stream of cotton coming from the cleaner may be divided so that one portion is handled by one bur machine, and the other by a second bur machine. These bur machines use a slowly revolving circular saw cylinder which is about 30 inches in diameter. The teeth of the saw hold locks of seed cotton, subject them to a carding and cleaning action as the cotton is spread across the periphery of the saw cylinder, and strip them

of the heavy trash and burs. These machines frequently have conventional spiked-drum-cleaning cylinders to supplement the cleaning action of the saw cylinder.

After the bur extracting process, the seed cotton is discharged into conventional or newly developed cylinder cleaners for a further cleaning action. At this point, the cotton may be subjected to a drying action and possibly passed through another 6- or 7-cylinder cleaner, or it may be dried en route from the bur machine to the cleaner. The cleaning at this stage may be a 6- to 15-cylinder cleaner or 2 inclined cleaners of 6 or 7 cylinders each. In some cases, a combined bur extracting and large sized cylinder cleaning unit may be used in place of the separate machines heretofore mentioned. The next stage of cleaning comes in the unit extractor feeders after the cotton is dropped into a conveyor distributor and distributed to the feeders. The extractor feeding processes above each gin stand may involve either small or large unit extractors used separately, or a combination of two, one placed above the other, and sometimes contain a cylinder cleaner attachment. Also, these machines may be equipped with drying elements for a final conditioning action on the seed cotton. These units are effective in removing burs, immature locks of cotton, and other foreign material left in the cotton by the overhead cleaning machinery. From the extractor feeders, the cotton is fed to the gin stands at a controlled rate of feeding.

The function of the early model gin stands was primarily that of separating the lint from the seed but, in modern gin stands, improvements have been made in huller fronts to increase their efficiency in removing large trash particles left in the cotton. Also, much effort has been put forth to improve the moting systems, and some unusual principles of moting and double moting processes are incorporated in present-day designs of gin stands.

With the elaborate systems of cleaning cotton prior to ginning just described, tests show that it is usually possible to remove about 80 percent of the foreign matter from rough hand-picked cotton and mechanically picked cotton, and 90 percent from snapped and from machine-stripped cotton. Of course, the gin stand itself supplements, to a small degree, the overhead cleaning action; but, even so, fine particles of vegetative matter, leaf particles, shale, etc., are left in the lint and spread over the fiber to the extent of greatly detracting from the grade of cottons that are roughly hand-picked or mechanically harvested even though this material is small in terms of weight.

Shirley analyzer tests show that, in a 500-pound bale of cotton, the foreign matter left in the lint after using an effective seed cotton cleaning system, ranges from 10 to 20 pounds for clean hand-picked cotton having from 50 to 150 pounds of trash when harvested; from 20 to 40 pounds for hand-snapped cotton, which at harvesting time contains 400 to 600 pounds of trash, the bulk of which is burs and stems; from 20 to 40 for mechanically picked cotton having foreign matter composed primarily of green or dry leaf particles amounting to 50 to 75 pounds at picking time; and from 30 to 60, or more, for machine-stripped cotton which at harvesting time generally contains from 800 to 1,200 pounds of sticks, stems, burs, and other foreign material like green bolls and leaves.

By the very fact that the foreign matter remaining in the ginned products has a tendency to become entangled with the ginned lint and not with the seed and because very little by weight is so held by the fibers, it can be seen that the cottonseed ginned from seed cotton cleaned in modern gins should be relatively trash free, especially when hand picked or mechanically picked under proper conditions. This may not necessarily be the case with hand-snapped cotton having weather damaged burs that tend to break apart in the cleaning and extracting processes or with machine-stripped cotton containing an excess of sticks and stems when harvested. In the Mississippi Valley, cotton is not snapped until late in the season and machine stripping is not practiced, and yet the problem of concern to the group here today is in this area, making it advisable to explore all possibilities for the production of linters not contaminated with foreign matter. These include the effects of gin cleaning as well as the influence of harvesting methods employed in the area.

Snapping, as practiced late in the season on weather-damaged cotton, embraced less than 0.5 percent of the production in Louisiana and only 6 percent in Mississippi in 1950 2/. However, the percentages of the crop so harvested in the States to the north, having a shorter growing season, amounted to 13 percent in Tennessee, 19 percent in Arkansas, and 32 percent in Missouri (table 1). An examination of the records of foreign matter content of the cottonseed produced in these states shows that the proportion of cottonseed having a foreign matter content of 2.1 percent and above was in direct relation to the percentage of cotton snapped, namely, 3.6, 5.7, 14.0, 14.5 and 34.9 percent, respectively 3/. The pattern for 1951 is similar when snapping percentages were 5, 3, 17, 20 and 27, respectively, and the proportions of seed having 2.1 percent or higher foreign matter content were 5.5, 3.8, 13.0, 13.0 and 25 percent.

A further indication that high foreign matter content of cottonseed is associated with the snapping method of harvesting employed late in the season is that cottonseed ginned from these harvestings average significantly higher in foreign matter content than those representing earlier pickings of seed cotton. This relationship would be even more striking if modernization of gins had not taken place.

In the light of this information, it is evident that in any investigation of the source of excess foreign matter in linters, evaluations of late season cottonseed should be made as compared with those for early and midseason. Should the stage of harvesting and associated snapping method be found the main contributor to the problem, methods for producing cleaner cottonseed at gins need further exploration. While ginning on elaborately equipped gins offers a possibility for aid in the solution of the problem, operating practices of these gins in some instances leave much to be desired, and there still remains in use a high proportion of gins in the Mississippi Valley that are only moderately equipped insofar as seed cotton cleaning is concerned.

2/ Charges for Cotton Ginning and Marketing Services and Related Data, Season 1950-51. U. S. Dept. of Agr., PMA, Cotton Branch, April 1951.

3/ Cottonseed Quality in the United States, 1950. U. S. Dept. of Agr., PMA, Cotton Branch, Nov. 1951.
Cottonseed Quality in the United States, 1951. U. S. Dept. of Agr., PMA, Cotton Branch, Nov. 1952.

Table 1.--Relationship of proportion of seed cotton snapped and percentage of cottonseed having 2.1 percent and higher foreign matter content in the Mississippi Valley States, crops of 1950 and 1951 1/

State	Proportion of cotton crop snapped		Proportion of cottonseed having 2.1 percent or higher foreign matter content 2/		Average foreign matter content for specified periods 2/					
					Early season		Midseason		Late season	
	1950	1951	1950	1951	1950	1951	1950	1951	1950	1951
	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Louisiana	3/	5	3.6	5.5	0.7	0.6	0.8	1.0	1.1	1.6
Mississippi	6	3	5.7	3.8	0.6	0.6	0.8	0.7	1.8	1.5
Tennessee	13	17	14.0	13.0	1.3	1.2	0.6	0.7	2.9	2.9
Arkansas	19	20	14.5	13.0	0.9	0.9	0.8	0.7	2.8	2.2
Missouri	32	27	34.9	25.1	1.6	2.2	0.7	0.8	3.9	3.8
Average	--	--	--	--	1.0	1.1	0.7	0.8	2.5	2.5

1/ Cottonseed Quality in the United States, 1950. U. S. Dept. of Agri., PMA, Cotton Branch, Nov. 1951.
Cottonseed Quality in the United States, 1951. U. S. Dept of Agri., PMA, Cotton Branch, Nov. 1952.
2/ Season beginning August 1.
3/ Less than 0.5 percent.

Field studies made by the Cotton Branch in the Mississippi Valley in recent years show that while elaborately equipped gins received a higher proportion of roughly harvested cotton late in the season than moderately equipped plants, the seed cotton after being subjected to cleaning in the two groups of gins had comparable foreign matter percentages 4/. This shows that adverse effects of excess foreign matter in cotton handled by the elaborate plants, above that for cotton received by the moderately equipped plants, were overcome by the extra cleaning equipment in the former. This relationship, of course, should also hold with the cottonseed. With trashiest late season machine-picked cotton averaging 14 percent in foreign matter content in the Mississippi Delta or about 200 pounds per bale, the gin cleaning machinery reduced the trash content to less than 50 pounds per bale, giving an average grade of lint of almost Low Middling with which is usually associated a foreign matter content of 35-40 pounds per bale. Thus, assuming that the gin stand itself removed only 5 pounds of trash, there would remain 10 pounds under extreme conditions to be discharged with the cottonseed, or only 1.2 percent. In the case of moderately equipped plants involved in the study, similar calculations with the late season machine-picked cotton having 140 pounds of foreign matter per bale shows that cleaning equipment removed 70 pounds. With the lint grading Strict Good Ordinary, its trash content would be about 55 pounds per bale, leaving 15 pounds. Deducting 5 pounds for gin stand trash removal, the final percentage of foreign matter in the cottonseed would be about 1.2 percent. Thus, although modern gins received cotton containing a higher proportion of foreign matter than poorly equipped plants, their ginned products--lint and cottonseed--were as free of foreign matter as those ginned on plants with less cleaning equipment.

Even in the elaborately equipped gins, there is a need for machines and processes for more effectively removing sticks and stems from snapped and machine harvested cotton. Also, the types of driers employed in gins have been designed primarily for drying the fiber in order to aid in the removal of foreign material and provide smoother ginned lint and not specifically for drying the seed. By reference to the information given in table 1, it will be noted that the early harvested seed, which usually are of high moisture content, contain more foreign matter on the average than those ginned during midseason when the seed cotton is harvested in a drier condition.

The U. S. Cotton Ginning Laboratory has been alert to the needs of the ginning industry in connection with equipment and processes that will effectively remove sticks and stems from cotton and that will be technically and economically feasible in drying and cleaning cottonseed at a rate commensurate with the present capacity of gins. Accordingly, a project concerned with the development of equipment of this kind has been in active progress during recent years. At present, development work is being intensified on a device for effectively removing sticks from seed cotton; and as rapidly as refinements in this equipment are made by the engineers, evaluations are being done cooperatively at the Laboratory with a view

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4/ Ross, John E., Jr., Montgomery, Robert A., and Fortenberry, William H., Costs and Quality of Cotton Ginning in Relation to Method of Harvesting and Type of Ginning Equipment, Yazoo-Miss. Delta, Seasons 1946-47 and 1947-48, U. S. Dept. of Agr., Cotton Branch, PMA, 1949. Processed.

Hudson, James F., and Montgomery, Robert A., Quality of Ginning Services in Relation to Cost of Ginning in South Louisiana, 1948 and 1949. Louisiana Bulletin No. 450, March 1951.

to perfecting a machine which will ultimately accomplish the objectives of the project and be of practical use in the gin.

The other project which is under way at Stoneville which will be of interest to this group is the development of a cottonseed drier. Preliminary tests thus far have shown this drier to be quite effective for drying seed of high moisture content and for the removal of foreign matter from the seed. Although the drier is being developed primarily for use in drying high moisture content seed and thus preserving them for planting purposes, it does have features incorporated in its design which along with drying make it appear very promising as a cleaner. Preliminary results have shown that as much as 90 percent of the foreign matter can be removed from cottonseed which pass through the drier. This foreign matter consists of sticks, leaf trash, and some grabbots.

Along with the development work on ginning machines, heretofore discussed as being of interest to cottonseed crushers, the Laboratory has provided the Agricultural Extension Services with information on operating practices that not only contribute to cleaner ginned lint but also to cleaner cottonseed produced at gins. Through these educational programs, ginners are being made acquainted with the advantages of producing clean seed both with respect to their increased value under the U. S. Official Grading system and to expanded market outlets for, and enhanced value of, linters. For example, a few years ago, it was not uncommon for ginners to divert the trash from the extractor feeders, the gin stand huller fronts and other machines to the cottonseed line to add weight, but this practice now is the exception rather than the rule, especially where seed are sold on grade. Ginners are also being urged to dump the seed rolls periodically in order to prevent undue accumulation of foreign matter like sticks and broken burs that may otherwise go into the seed. Through the educational program, it has been pointed out that the ginner loses by having to haul additional weight to the oil mill and also by having the seed bring a lower price because of reductions in grade due to excess foreign matter.

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"USE OF CARVER PNEUMATIC ATTACHMENT"

By
Allen Smith
Perkins Oil Company

You will be glad to hear that a fuller and more complete discussion will follow this paper. The Carver Gin Company, through Mr. T. P. Wallace, has engineered and developed this pneumatic attachment. Your speaker wishes to mention briefly some of the high points and give you some figures and let Mr. Wallace then tell more about the use of the Carver Pneumatic attachment.

A short time past, you can well remember, the question of lint quality had little place in oil mill operation. Even with our old linter brushes turning fast enough to put everything, almost, into second cut lint and with very little lint cleaning the oil mills could not supply enough weight to satisfy the demand for second cut lint. Today, as you know, the situation has changed and now demanding that something be done about the quality of lint.

Following you will find a table giving information as to the amount of lint on seed received, the amount left on the delinted seed and the analyses of our second cut lint. You will also find figures showing the calculated or expected lint yields. The column at the right shows the difference between calculated and actual yields. These figures are composite averages of all the seed milled at both plants, Perkins and West Memphis for each season since 1946-1947.

Season	% Lint On Mill Seed	% Lint On De-Linted	Second Cut Lint % Moisture	Second Cut Lint % Cellulose	Yields Calculated	Yields Actual	Pounds Difference
1946-47	10.81	1.48	8.24	72.48	214.5	204.2	- 10.3
1947-48	10.24	1.16	7.93	72.90	204.6	191.5	- 13.1
1948-49	10.36	1.53	6.32	74.23	200.1	189.3	- 10.8
1949-50	10.43	1.37	6.48	74.90	200.4	194.5	- 5.9
1950-51	10.35	1.54	8.03	69.6	201.8	193.2	- 8.6
1951-52	10.21	1.36	7.11	72.6	192.2	191.1	- 1.1
To Date	10.28	1.20	6.77	75.0	195.9	198.0	Plus 2.1

In January 1951 our linters were converted from brush to pneumatic type linters. In October 1952 an improved type of Carver Pneumatic attachment was installed. By inspection of data from 1946-1947 through 1950-1951 we find that the mills failed by an average of 9.7 pounds per ton in producing the laboratory calculated yield. The first season, 1951-1952, that the Pneumatic linters were used, this difference between calculated and actual cut was reduced to 1.1 #/ton. This season 1952-1953 is not finished. However, you will note that the difference between calculated and actual cut is not a minus quantity but is 2.1 #/ton on the plus side of the ledger.

As to the cellulose content of the lint, it is possible to adjust your air through this system in such a manner that the cellulose content will be in the range of first cut lint. Second cut lint has been produced having 80% cellulose content. This same lint ran about 74% cellulose when coming direct from the linters. This sounds good - however, when you figure your net returns for lint produced from one ton of cottonseed, the practice is better to cut as many pounds of lint as you can sell and let the cellulose content take care of itself. In other words, we discontinued making the 80% cellulose lint and baled up more pounds per ton at 75% cellulose content. As stated in my previous paper, this lint of 75% cellulose has been going to market at a premium above current price level.

It has already been stated that we are using, in addition to reels and Bauer Bros. Cleaners, the air separators at our West Memphis plant. At Memphis we do not have the air separators. Both mills are crushing about 150 tons per day - and our lint cut at each mill is about the same. The first cut at each mill will average more than 30% of our total cut. The total foreign matter, late season seed, is around 2% going to our mill.

In conclusion and before Mr. Wallace takes over, let me restate that the question of cellulose yield is not a problem. However, care must be taken in

adjusting your air in the system or else the cellulose content will be too high for most profitable operation. This pneumatic attachment is not removing 100% of shale and hull, but will produce under similar seed conditions and linter adjustments more pounds of lint of higher quality than we have been able to make with previous delinting equipment.

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CLEANING COTTON LINTERS

By
T. P. Wallace*
Carver Cotton Gin Company

The subject of cleaning lint has a long history which I will not attempt to go into entirely but will endeavor to bring you up to the present time.

All of you know that the wood pulp scare has been thrown at the mills for twenty years but this looks as though it has become a definite factor and we have got to meet this challenge.

On the subject of cleaning lint, there are several devices working on the end, all of which do some good but not good enough. We have been working on an idea of cleaning lint as it is made on each individual linter which has brought about the individual pneumatic linter attachment, therefore, we are only handling some twenty-five to fifty pounds of lint per linter through this attachment in cleaning lint in a smaller volume we get a better grade of lint. The quantity of lint handled depends entirely on the number of linters and the cuts being made through the mill.

It would involve a good deal of time to go into the various phases of the number of linters being used on different cuts which has to be arranged to fit into individual mill problems.

There are a good many of you gentlemen here that are using our pneumatic linter attachments and are familiar with this operation. We have here a cross section of the pneumatic attachment and I will point out the different phases in its operation. As to cleaning second, third and fourth cut lint we have this problem pretty well solved with our present seed cleaning machinery and we are doing a good job.

We have got to do something about cleaning cottonseed which will take some of the burden off the first cut linters which in recent years have become our best seed cleaning machinery, however, this is affecting the grade of first cut linters.

We have some samples to show anyone that is interested which I believe will bring out the fine points of the pneumatic attachment. We now have sixteen mills in the memphis territory equipped with the pneumatic attachments and they are all operating very satisfactory and are making excellent chemical lint.

If any of the cottonseed oil mill managers or superintendents would like to have further information after the meeting Mr. J. R. Hamlett or myself will be

*Presented by Allen Smith

glad to discuss the matter further.

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LINTER REQUIREMENTS FOR PAPER MANUFACTURE

By
B. B. ANNIS
Memphis, Tenn.

For the past thirty years or more, the production of second cut linters has been controlled with the sole object of making a suitable raw material for dissolving pulp. The cleanliness of the seed and linters has been so controlled that the maximum amount of cellulose has been removed from the seed while incorporating the least amount of undesirable trash in the resulting linters.

Within the last decade, a gradually increasing amount of second cuts has been going to the fine writing paper manufacturers to be used in cotton content paper. The paper mills have taken these second cuts as they found them, but by limiting the percentage of linters in the cotton content of the paper, they have been able to use them.

Now that the oil mills are faced with a possible sharp curtailment of the dissolving pulp market, it will become increasingly desirable to make linters with specifications drawn for paper mill use, thus increasing this market as the dissolving pulp market declines.

This type of linters will differ from that made for the chemical trade in two fundamental characteristics. First, the fibre becomes of primary importance rather than the chemical purity of the cellulose. This fibre does not necessarily have to be longer than the longest fibres in a second cut, but the content of short fibres and dust must be eliminated so that as much as possible of the linters content will have some fibre length. The second fundamental difference is that of the character of the trash allowable. For instance, the more drastic chemical purification of dissolving pulp completely eliminated hull pepper, but as the paper manufacturer is trying to chemically treat his raw material as lightly as possible so that the strength of the fibre is retained, he finds that hull pepper remains as black specks which are very undesirable. On the other hand, light colored small bits of shale and sticks while undesirable, are not the major difficulty.

In conclusion, may I point out that the future of the linters market may not be as gloomy as we have thought. The dissolving pulp manufacturers have been using something like 600,000 bales per year. At the worst, I doubt if this market will be more than cut in half. The paper manufacturers have been using between 40,000 and 80,000 bales per year, but can use at least five times this quantity if the linters are made right. They can thus almost exactly absorb your lost chemical market if you are willing to face the problem squarely that

you must now produce three types of lint, namely: (1) a good staple first cut, (2) a clean uniform fibre second cut or middle cut, leaving at least 50 or 60 pounds or more of fibre on the seed, and (3) a shorter, clean, pure cellulose for dissolving pulp. Each oil mill should consider this problem seriously during the coming spring and early summer months so that if they find it advisable to produce for this new market, they can rearrange their present equipment or add to it if necessary so that they will be ready this fall for any basic change in demand.

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REPORT OF THE SUB-COMMITTEE ON LINT CLEANING

By
F. M. Wells, Chairman
Buckeye Cotton Oil Company

We want to talk a few minutes to try to follow up Mr. Verdery's discussion of an industry-wide attack on seed cleaning as applied also to lint cleaning. Devoting our major effort to cleaning lint instead of to cleaning seed is tantamount to closing the barn doors after the bull is out. Without question, the basic problem is to improve seed cleaning. Even when this is done, we may be forced by market conditions to produce lint higher in quality than we now consider to be satisfactory. Our old standards of lint quality may no longer apply. Our ultimate goal may well be to produce economically lint with a very low content of foreign material and up to near the pure lint cellulose content of 80-82%. We want not only to provide the pulp industry with the best possible lint, should it become necessary to do so, but we want also to attract other possible users by offering them a clean product, rather than a dirty one.

Let us base our approach on how an industry-wide attack can be made on where in the industry interest and help can be found. The only available places are: (1) oil mill operators, (2) equipment manufacturers, and (3) government and state research laboratories and institutions.

1. Oil Mills

The primary need of oil mills in their attack on the lint quality problem is to be able to define specifically the source or cause of their problems. Generally, poor quality lint originates from either dry or fragile seed, trashy seed, or improper arrangement or operation of the processing equipment. Trouble stemming from these conditions are distinctly different and should be analyzed as such. Let me sight as an example a recent experience at one of our valley mills.

For many years we had cut as good and as much lint at this mill as at others. The records were good and consistent. All linters were of the brush type and linter capacity was adequate. We had no motes conveyors under the second cut linters. Last summer we installed conveying equipment to change from two to three cuts. At the beginning of the season we cut good lint. Lint quality stayed high until the seed being received became very dry. The seed were relatively clean. When we began processing these dry we had no trouble making

cellulose; but the shale count became too high. The problem was not a severe one as the trash content was just over that considered minimum for satisfactory quality. It was easy to see that the high shale count was caused by large hull particles only and not by broken trash. It took us some time to realize that the system as installed would be satisfactory for normal moisture seed but on dry seed the chipping of broken hulls in the third cut linters was the cause of the high shale count. The dry seed shattered in the second cut linters and no means had been provided for preventing these broken hulls from reaching the third cut linters. We did not want to shut down and make major changes in the system and by humidifying seed and installing perforated conveyor box between second and third cut linters we were barely able to reduce shale count to a satisfactory level. While we are down this summer we will correct the situation by installing motes conveyors under the second cut linters or by cleaning seed between second and third cut.

We need to have a record of many experiences such as this to work on the problem industry-wide. Such problems with solutions when obtained should be sent to a clearing point for appraisal and publication to oil mill operators interested in cooperating in such a program.

2. Equipment Manufacturers

Any oil mill operators should feel it a privilege to cooperate with an equipment manufacturer in the test or development of new equipment. The equipment manufacturers return from such development must be in proportion to development expense and production costs. The equipment manufacturer cannot do development work as a token of charity to the oil milling industry and his return from such development, if successful, must be in proportion to development expense and production cost. We must provide incentive for this development by not reproducing his equipment with our own means if the manufacturer is charging a fair price, and I am sure that all of us will agree that the oil milling industry is supported by a group of equipment manufacturers with as good or better record for fair trading as that of any other industry association.

It behooves the equipment manufacturer that once the development of equipment is complete, to have for other prospective users specific details and quantitative data as to what the equipment will and will not do. The analysis of the cleaning system given by Mr. Smith is typical of what would go far in selling any equipment when the results are sufficiently impressive.

3. Government and State Research Laboratories

I know that all of us who received a copy of the preliminary working report by Mr. Gastrock were delightfully pleased at the scope and thoroughness with which he has already approached our lint quality problem. This shows real interest in our problem, and most of all the will to do something for the industry. Mr. Gastrock's Division can do nothing more than we help him to do by providing problems and suggested ideas for solutions and keeping him informed of the progress in improving lint at the many mills. I am sure we all commend him and his people very highly for this preliminary survey.

Let's support this work with our highest enthusiasm and cooperation.

We must enlist other state and national organizations also. We must publicize our problem to ginners in an effort to obtain their support.

We can summarize these thoughts on an industry-wide attack on lint cleaning by saying that the collective work of the cooperating organizations will be successful to no greater extent than the degree of cooperation obtained from oil mill operators.

We want to re-emphasize as being necessary to the proper functioning of the lint cleaning development program, the supplying by oil mill operators of all information on problems and progress in lint cleaning for publication by the sub-committee. In conjunction with the sub-committee on seed cleaning, the sub-committee on lint cleaning should secure as an advisory group to the Southern Regional Research Laboratory and other organizations participating in this development program. Today's discussions as assembled and edited by the Laboratory will constitute the report of development work for improving lint cleaning for the current season.

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March 10, 1953

RESOLVED by those attending the Cottonseed Processing Clinic of the Valley Oilseed Processors Association, Incorporated:

That, this second cottonseed processing clinic has stimulated interest of large numbers of the industry. It has brought about a much better understanding between industry and the members of the Southern Regional Research Laboratory which should lead to the continuance of a research program calculated to produce beneficial results.

It is recognized by this group that basic or fundamental research is important and essential, but it is also our feeling that applied research is of equal importance. It is our hope that we can present to the Southern Regional Research Laboratory staff from time to time some of the pressing problems that confront this industry.

As one of the evident demonstrations of applied research we have found the pilot plant facilities of the Laboratory to be of special interest. We would like to see these facilities expanded, if necessary, to undertake new studies that may arise.

Signed: ______________________________
J. B. Perry, Jr.

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J. R. Mays, Jr.

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R. F. Patterson

March 10, 1953

RESOLVED by those attending the Cottonseed Processing Clinic of the Valley Oilseed Processors Association, Incorporated:

That we extend to Dr. Fisher and the Staff of the Southern Regional Research Laboratory our deep appreciation for the fine conference just concluded and the many courtesies extended to us during this conference including the making of hotel reservations.

We also wish to express our appreciation to those who appeared on our program, realizing the amount of time and study that was necessary in the preparation of subjects discussed on the program.

Signed: ______________________
J. B. Perry, Jr.

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J. R. Mays, Jr.

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R. F. Patterson

March 10, 1953

RESOLVED that:

It is the sense of this meeting that our thanks be extended to the gentlemen composing the committees heading up this research program, and that the work be continued under the same committee set-up another year.

Signed: ______________________
J. B. PERRY, JR.

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J. R. MAYS, JR.

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R. F. PATTERSON

A P P E N D I X

CLEANING OF COTTONSEED AND LINTERS

Preliminary Working Report*

Submitted by
E. A. Gastrock
Southern Regional Research Laboratory

Contents:

*NOTE:
This report was included in the minutes of the meeting by a motion made by Mr. Ralph Woodruff, seconded and passed.

1. Foreword: All information presented in this report including recommendations drawn therefrom are based on first hand information obtained during the first six weeks of a preliminary survey of current methods for cleaning cottonseed and linters. In presenting the information thus far obtained in this preliminary survey along with the recommendations, it is not the intention of the authors, or the policy of the U. S. Department of Agriculture to promote or discredit any commercial make of cottonseed or linters cleaner, or other units used in this work; nor any manufacturers, distributors, or users of this equipment. The sole object of this report is to help focus attention on the problems presented, current efforts being undertaken to effect a solution, and possibilities for further work of an immediate and longer range nature.

It is to be emphasized, too, that because of its present status the survey is not complete, further information will be sought and collected and the authors will be receptive to any further pertinent information available from the industry. Thus, the findings should be considered as tentative and may be revised later as additional information is received.

2. Origin of the Problem: In the 5-year period prior to War I, 1910-1914, linters averaged 2.13 cents per pound, accounted for 4.5% of the value of the products derived from a ton of cottonseed and were produced at the rate of 63 pounds per ton of cottonseed. In the season 1950-51 linters averaged over 16 cents per pound, accounted for about 22 percent of the value of the products derived from a ton of cottonseed and were produced at a rate of about 185 pounds per ton of cottonseed.

This point of economic significance was achieved as a result of steadily increasing industrial requirements for linters. It was accentuated in 1950-51 by a small crop of cottonseed.

Since 1950-51 the situation has deteriorated. Although overall demand for the products (both felting and chemical grades) in which linters are used remains good, competitive materials, chiefly dissolving grade wood pulp, are improving tremendously in quality and may soon be produced in quantity to meet all anticipated demands. Large current crops of cottonseed have resulted in an apparent oversupply of linters. However, of greatest significance in this competitive market is the ability to produce clean linters. The continuing increase in mechanical harvesting of cotton and the use of snapping, stripping, and sledding methods in gathering the crop have resulted in increasing percentages of foreign matter in the seed cotton as delivered to the gins. In spite of improvements in cleaning methods at the gins, the percentages of certain types of potential linter-degrading foreign matter in the cottonseed as subsequently delivered to the mills is generally too high to allow effective removal by the standard types of oil mill seed cleaning equipment.

The problem was recognized and discussed in considerable detail at the First Processing Clinic, a working conference held at the Southern Regional Research Laboratory in cooperation with the Valley Oilseed Processors Association, April 14-15, 1952.

During the current processing season the problem was reported to have grown worse and several months ago officials of the Valley Oilseed Processing Association conferred with members of the Oilseed Section of the Southern Regional Research Laboratory Research Council to determine if work could be undertaken by the Laboratory to improve the cleaning of cottonseed and linters.

As a result of this conference,held at the beginning of this year, the Laboratory agreed to conduct a survey in an effort to determine the extent and seriousness of the problem, the possibilities of technological solution, and to indicate what contributions it might be able to make towards its solution.

3. Basis for Report: This report is based on first hand information obtained as a result of visits during the past six weeks to eight cottonseed oil mills, three cotton gins, one linters pulp plant, and three equipment manufacturers. Thus far we have made visits to the Stoneville and Memphis areas of the Delta regiodn and to Lubbock and vicinity for the West Texas region.

We have been assisted by the officials of the National Cotton Council and the National Cottonseed Products Association and have attended a conference called by the Valley Oilseed Processors Association in Memphis, Tennessee, where the problem in cleaning cottonseed and linters for this region was clearly defined.

Phases of the problem were discussed with appropriate persons at the Southern Regional Research Laboratory such as members of the Cotton Mechanical Processing Division, Analytical and Physical Chemical Division, Cotton Fiber Research Division, Mechanical Service Division and Engineering and Development Division.

4. Conditions in the Delta Area: Harvesting methods used in this area are in process of change. Hand picking of cotton is rapidly being replaced by mechanical harvesting. The mechanical cotton picker now harvests about 15 percent of the crop, but its use is increasing. In many instances there is a lower percentage of foreign materials in cotton harvested by this method than by hand picking.

We have received scattered reports (sometimes contradictory) in connection with the return of some foreign material removed from seed cotton at the gins back into the cottonseed. In one report it was stated that on visits to gins, trash from super cleaners was observed flowing into the seed stream. Payment for cottonseed is largely on a weight basis with an allowance for one percent foreign material. This may be an inducement for returning trash to seed containing less than one percent foreign material.

It was stated that the percentage of foreign material in cottonseed as received from the gins varies from 1-2 percent, and averages somewhat over 1.0 percent.

At the oil mills visited, sand and boll reels are used, generally, to remove large trash and sticks from the cottonseed before it is passed to the Bauer Brothers No. 199 seed cleaning units with pneumatic attachments. Results of tests conducted at one mill indicate the sand and boll reels remove about 15-20% of the sticks and most of the fines and dirt. The Bauer Brothers cleaner practically completes the removal of the fines but when used following the reels, does not contribute much to stick removal. The moting device on the first cut linters removes about 1/3 of the total trash (a large part of which is sticks); however, sticks removed here have been subjected to considerable abrasion by the first cut linter saws and much bark and fine splinters have been removed from them and thus become associated with the linters.

One mill reported they could make acceptable second cut linters when the percentage of sticks was 0.2%, but 0.3% sticks would begin to give them trouble. With exceptionally dirty seed containing as much as 2% trash, it was impossible for this mill to produce a satisfactory grade of second cut linters from the seed, and the linters could only be sold at a considerable discount.

From our visit to a linters pulp plant we observed that a new wet process for cleaning linters was being used to assure a clean raw material. Necessity for clean linters was clearly evident throughout the bleaching process. Pulp in the form of sheets is examined against a lighted background for minute specks of foreign materials.

It was suggested that use of air for separation of sticks from cottonseed be avoided, if possible, due to rapid increase in power demand with capacity. (This is in contrast to the impression received in the West Texas Area that air should be used if it contributes to the solution.)

5. <u>Conditions in the West Texas Area:</u> The harvesting methods used in the West Texas region are different from those of the Delta. In the West Texas region, the cotton is hand-picked until the first frost occurs after which the remainder of the crop is sledded or stripped. This causes a sudden load on the mill and in some cases it is necessary to pile the seed on the ground until it can be transferred to storage tanks or houses.

Because of the high winds and dust storms in this area, a special variety of cotton is planted that matures early. The boll does not open fully, thus protecting the cotton from damage due to storms and dust. There are about seven different varieties of cotton planted, each of which has advantages under certain soil conditions.

Sterilization is necessary because of the pink boll worm. Approximately 3/4 of the cotton-growing areas are affected by this pest.

Out of the five mills visited, one reported rejection of several cars of linters because of excess trash. The foreign material in the cottonseed as received from the gins varies from 2-6 percent, and averages about 3%. Sticks average about 1% and fine trash 1%.

They depend almost entirely upon shaker screens to remove the large foreign material, sand, and dirt that are generally removed by sand and boll reels in the Delta Area. These units, which are Bauer Brothers No. 199 Seed Cleaning Units, remove about 50% of the trash from the cottonseed. Some sticks are removed by use of rotolifts equipped with slotted pipe.

One mill visited makes four linter cuts, utilizing the fact that the linter machines are good cleaners, and that linters from the various cuts can be blended to obtain required quality. Lint beaters and pneumatic cleaners are used to further improve the quality of the linters.

5.a. What they are doing about the problem in the Delta Area. An equipment manufacturer has developed a pneumatic attachment for the second cut linter machines. Use of this device has increased the cellulose content of linters by 3-4% and reduces dirt and trash content far enough to meet present standards when handling moderately trashy cottonseed. We were assured, however, that this device was not considered to be the final answer to the cottonseed and linters cleaning problem.

The "Whirligig" as manufactured by National Blow Pipe and Manufacturing Company, Limited, of New Orleans utilizes centrifugal force and is effective in removing some hulls, sticks, meats, etc., from first or second cut linters. We have no quantitative data on the performance of this unit but have observed it in operation.

We attended a conference called by the Valley Oilseed Processors Association at which mill managers, equipment manufacturers, members of the National Cotton Council, and representatives of National Cottonseed Products Association, and the Production and Marketing Administration were present. At this meeting the following points were decided:

A. The problem of cleaning cottonseed and linters is a problem of the oil mills. This decision, however, should not deter or diminish work in progress to improve seed cleaning at gins.

B. The major problem of cleaning cottonseed and linters could be pin-pointed to one of removing the sticks. Existing methods for removing shale particles, hull bran and hull pepper from linters were deemed satisfactory.

C. If possible, the seed should be cleaned before they are stored.

D. It would appear that a starting point for removal of trash from cottonseed should include the idea that seed must be fed in a layer one seed thick, and this layer should be further spread out that enough space for separation is provided between individual particles of the stream. This should provide the greatest opportunity for separation of trash from seed.

E. We should try new approaches in solving this problem. It was stated that no radically new idea for the cleaning of cottonseed has been proposed during the past 25-30 years. (However, we found several approaches that seem new.)

F. Members of seed cleaning and linters cleaning committees were requested to collect further data in connection with this problem and to submit same to chairman of the committees who would report findings during the Clinic on March 8 through 10.

G. It was generally agreed that application of the reflux or recycling principle to the mechanism of seed cleaning operation should be investigated. This principle involves multiple separating steps so grouped that at one end of the group essentially 100% clean seed are discharged and that at the other end 100% trash and sticks are discharged and the intermediate steps are arranged for recycling in such a manner as to accomplish the first two results without unfavorably affecting the overall capacity of the system. The currently used linter beater system makes use, in part, of such a principle as proposed here.

H. It was generally thought that it would be easier to remove the sticks and trash from the seed than to remove the seed from the sticks and the trash. Several approaches to the problem of cleaning cottonseed were mentioned and a general idea of each is included below:

(a) Use of static electricity.

(b) Use of a rotating slotted pipe shaft fitted with disks. Slots are made in the pipe parallel to the length. Disks fitted on this pipe are perpendicular to the pipe and are spaced to allow optimum flow of one seed thick layers of seed between them. When the shaft is rotated and suction applied to top of shaft, sticks may be repelled by the disks and seed allowed to pass into the pipe and be withdrawn.

(c) Use of a moving screen and blowing the seed and sticks against the underside of the screen allowing the seed to pass through and the sticks to be removed.

(d) Use of inclined shaker screens with four trays arranged for series flow and with perforations in each tray, different and increasing (in size of perforations) from the first to the fourth. At the end of each tray sticks are collected from the overs and the seed is routed to the tray below.

(e) Use of the general idea of an inclined saw tooth cleaner. This unit would closely resemble the six-cylinder inclined cleaners as used in the cotton gins.

b. <u>What they are doing about cleaning cottonseed in the West Texas Region.</u> As in the Delta Area, mills in this region are trying to increase the effectiveness of existing equipment. For example, one has installed two extra trays on their Bauer Brothers No. 199 Seed Cleaning Unit, and another has developed and installed a basket type cleaner at the discharge end of the pneumatic attachment and following the first cut linters. Further efforts to improve the efficiency of separation of the Bauer unit include plans to rearrange the perforated metal suctions to produce a fraction containing a higher percentage of clean seed and another fraction having a high percentage of sticks, shale, and large trash. The overall purpose is a more

efficient use of the large screening area of the enlarged Bauer unit. Possibility of recycling certain fractions to obtain pure seed fraction are being considered.

They are also removing some sticks, most of the remaining sand, much pops, and much fine field trash after the Bauer Brothers No. 199 Seed Cleaning Unit, using the newly developed "Camco" or basket-type cleaner.

The basket type cleaner is also being used after the first cut linters where more sticks, pops, and fine trash are removed.

One mill operator stated he had produced acceptable linters from straight bollie seed, but now uses 1/2 bollie seed and 1/2 early harvested seed (hand picked).

One mill superintendent is of the opinion that several machines or devices are necessary to the cleaning of cottonseed and linters since various types of foreign matter require different means of separation. In this mill fractions from the shaker screens are separated further by pneumatic means to recover meats and seed and to discard sticks, sand, and fine field trash. Careful operation of the linter machines and use of "Vacuum drops" and linter beaters allow him to produce acceptable second cut linters.

Use of the Lucian Cole linters cleaner has been observed in the Lubbock area. This unit utilizes centrifugal force to throw out the heavies fraction from the linters. It consists of a spiral duct installed in a vertical position within an airtight cylindrical casing with the cross-section of the duct increasing towards the bottom or discharge end. Slots are provided at various locations on the outer circumference of the duct and air is allowed to enter at various heights. We have no quantitative date on the performance of this unit but have observed it in operation. It removes appreciable quantities of trash. Use of the "Whirligig" was also observed in the Lubbock Area.

7. Overall Recommendations:

A. At Gins

(1) The work of the Southern Regional Research Laboratory does not involve problems of the cotton gins, those being the work of the U. S. Cotton Ginning Laboratory at Stoneville, Mississippi, in another Bureau. This ginning laboratory, an oil mill, and a gin in that vicinity were visited in order to obtain first hand knowledge of the methods and practices in cleaning seed cotton and their relationship to the cleaning of cottonseed. Two important factors were found that have a direct effect upon the condition of the cottonseed as received at the oil mill.

These factors and recommended remedies follow:

(a) There is a general feeling that some of the trash removed from the seed during the ginning operations finds its way back into the cottonseed before it is shipped to the oil mill. Information should be sought concerning the extent of this practice and an educational effort should be made to correct the practice if found.

(b) Removal of sticks as fast as they accumulate in the seed roll of the gin would prevent them from contacting the gin saws causing removal of bark from the sticks and production of the hairlike particles so objectionable to users of second cut linters for chemical purposes. Discussions with gin operators and technical personnel of oil mills has resulted in an idea that might eliminate these sticks from the seed roll as they accumulate Since this problem falls within the scope of work of the U. S. Cotton Ginning Laboratory at Stoneville, this idea should be submitted to them for further consideration.

B. At the Oil Mill

It was pointed out by Valley authorities that the problem of cleaning cottonseed or removing the sticks is essentially a problem of oil mills. Several reasons were given to justify this attitude. First, is the fact that since there are about 235 mills as compared with about 7500 gins or a ratio of about 30 to 1, it would require considerably more time and money to equip all of these gins with stick removal units that would be required to equip the mills. Also, gins operate for only relatively short periods during the year averaging about 75 to 100 days. Oil mills run for longer periods, 200 to 300 days. Thus, about three times as much cleaning equipment would be required to do the job at the gins as is required to do the same job at the oil mills. It would be more efficiently used at the oil mills. In addition, it is possible that a mill could receive clean seed from several gins, but it would require only a few loads of poorly cleaned seed from one or two other gins to make installation of a stick removal unit necessary at the mill. Further, we should not discount the possibility of removing the sticks at the mill through modifications to existing seed cleaning units, or by supplementing them with devices based on principles of separation that are different from or more efficient than those used today. It was clearly brought out by Valley authorities, however, that this assumption of responsibility by the mills should not cause relaxation on education efforts at the gins and in research programs to improve both seed cotton and cottonseed cleaning at the gins.

While every effort is being made to clean cottonseed in order to insure clean linters, we should give some attention to the possibility of finding new markets for linters. This is considered wise because in the near future for some uses, "clean" linters may have to compete with substitute products on price alone. What the next few years will bring in the line of low cost substitute products is hard to predict. Buckeye and Hercules are working on new markets for linters.

Several ideas for separation of the sticks from cottonseed were offered by managers, superintendents of mills, and others. A few of them

are listed below:

A. Use of Electrostatic Force. Separation of the sticks because of their ability to carry a greater charge of electricity than the seed may have promise. Reports from one mill working on this type separation indicate voltages in excess of 15,000 may be required for the separation. Further work is being carried out along these lines.

B. Use of a spiked drum with spikes located close enough to support sticks horizontally and the drum rotating in opposition to the seed flow may be effective in carrying the sticks over to a separate outlet. A series of these units arrange one above the other with common seed and stick-and-large-trash outlets enclosed in a common casing may have possibilities.

C. (a) Use of a moving metal screen having mesh size sufficiently large to allow passage of seed should remove sticks if the uncleaned seed is blown against the underside of the screen.

(b) Use of supersonic sound waves to cause movement of the uncleaned seed towards the moving screen in lieu of pneumatic means mentioned under C (a) above.

D. Use of a revolving table onto which the cottonseed is fed at the center and the separation effected by centrifugal force. One report of a trial of this idea was not too encouraging.

E. Use of a revolving hollow shaft slotted and fitted with discs spaced to allow passage of seed but not sticks approaching parallel to axis of revolving shaft. Suction is to be maintained in the tube to remove the seed as they pass through the slots and enter the hollow shaft.

8. Immediate Recommendations: Until the problem of removing sticks from cottonseed can be solved, we believe further attention should be given to the possibility of improving the usefulness of existing cleaning equipment and the possibility of incorporating into their operation new ideas for separation of sticks and other foreign matter. These suggestions include investigations which we believe could be classed as "short-term" or immediate investigations, as follows:

A. Increase the number of trays of the Bauer Brothers No. 199 Seed Cleaning Units from 2 to 4. Mr. Verdery has effected this improvement at the Western Cotton Oil Company. This spreads out the layers of seeds and makes it easier for seed to separate from the sticks. Smaller perforations, about 7/16" in diameter, are used on the first two sections of the shaker. With the thinner layer of seed and trash, the seed and fine trash can pass through but more sticks are held. However, so that no seed are discharged with sticks, large openings 1/2" and larger are used at the lower ends of screens No. 1 and No. 2. These permit more sticks to pass through and to some extent, undo the good work of the first sections of these screens. Furthermore, the screens appear to be very lightly loaded over the lower half.

As now used the screens No. 1 and No. 2 remove some sticks and large trash and the screens No. 3 and No. 4 remove 90 to 95% of the fine trash.

A further change contemplated involved using screen No. 3 also for stick and large trash removal, combining the "overs" from screens No. 1 and No. 2 on screen No. 3. The use of small perforations "all the way" will be tried. Screen No. 4 will then receive the "throughs" from screens No. 1 and No. 2, and will be fitted with 1/8" X 1" slotted perforations to remove sand and fine trash should be considered.

The proper size perforated metal plate sections for the four trays, and their arrangement should be determined and possible use of the re-cycling or "reflux" principle in separation of pure fractions of seed and of sticks and trash.

B. Use of the basket-type cleaner of "Camco" cleaner, as suggested by Mr. Callaway of the Plains Co-op Mill at Lubbock, Texas, for further removal of sticks, small field trash, some shale, practically all sand and pops.

NOTE: Use of this cleaner at the first cut linters will further help in improving the second cut linters.

We do not have much quantitative data on the effectiveness of this cleaner as a stick remover, but we have observed its operation. It appears to be very effective for removal of sand and pops. It is not being recommended as the complete answer to the stick problem but it does remove some of them.

C. Possible improvement in the pneumatic attachment for the Bauer Brothers No. 199 Seed Cleaning Unit. To date we have been unable to discuss this point with Bauer Brothers Company in the light of several suggestions we have received and until we can discuss these ideas with this company we forego further comment on this point.

D. Proper operation of linter machines will help improve quality of the linters. The quantity of motes should not be increased to a point beyond which there is decrease in quality. Possibility of improving quality of linters by individual rather than header controlled suction should be considered.

E. The pneumatic attachment for second cut linter machines as offered the Carver Cotton Gin Company removes considerable heavies from the second cut linters utilizing centrifugal separation and air aspiration principles. This attachment is not offered as the final answer to the cleaning of second cut linters. It was strongly recommended that "we should make every effort to remove the sticks which is considered the main deterrent in producing acceptable linters."

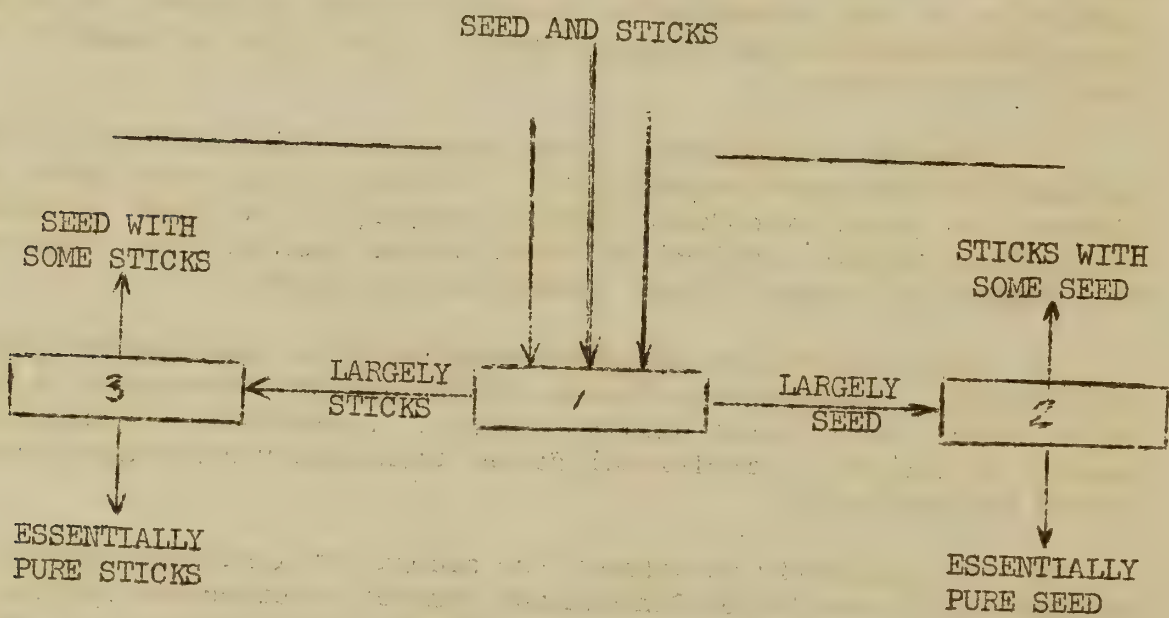
9. What the Southern Regional Research Laboratory Might Do: A limited amount of exploratory work has been started on one idea using new methods and principles of separation hitherto unused in the mills. In this work,

mechanical means will be used to impart differential particle velocities or acceleration rates, directional or tengential, to effect separations in lieu of screening or aspiration methods which are now used and are not entirely satisfactory. We plan to utilize recycling or "reflux" principles in the event our first pass operations are partially effective.

In the trial of this idea, a conveyor is being constructed with adjustable angle of inclination, and with variable speed drive. Belt speeds up to 5000 ft/min and angles of inclination up to approximately 20° will be tried.

Using the basic concept of feeding the seed onto the belt to obtain thickness not exceeding one seed thick, it may be possible to determine a critical angle of inclination and belt speed that will cause the sticks to line up parallel to the belt before they are thrown from the end. As explained previously, portions of seed from which some sticks have been separated will be recycled to increase the effectiveness of the separation until seed essentially free from sticks is obtained.

Application of the above idea to the cleaning of cottonseed before storage would be possible if belt speeds of 5000 ft/min are found effective. For example, calculations show that a 36" wide belt travel-ing at 1000 ft/min might handle approximately 225 tons cottonseed/day, and three such units travelling at 5000 ft/min, and arranged for recycling might handle over 1000 tons/day. Flow sheet for this idea follow:



P R O G R A M

March 9, 1953 - 10:15 a.m. Chairman, P. R. Dawson, SRRL
Auditorium - Third Floor

1. 10:15 a.m. Welcome - C. H. Fisher, Director, SRRL

2. Response - W. B. Stone, Swift and Company Oil Mill, Cairo, Ill., President, VOPA.

3. 10:30 The Research Program of the Bureau on Cottonseed
T. H. Hopper, Head, Analytical, Physical-Chemical and Physics Division, SRRL

4. 11:00 Research on Conditions of Processing Cottonseed to Improve the Quality of Oil and Meal
A. M. Altschul, Head, Oilseed Division, SRRL

5. 11:30 Expeller Produced Cottonseed Oil versus Hydraulic Pressed Cottonseed Oil
Wales Newby and E. D. Giles, Cotton Products Co., Inc., Opelousas, Louisiana

12:30 p.m. Luncheon - SRRL

March 9, 1953 - 1:30 p.m. Chairman, P. R. Dawson, SRRL
Auditorium - Third Floor

6. 1:30 p.m. Review of Pilot-Plant Experiments on Relationship of Conditions of Preparing Cottonseed to Processing Efficiency and Quality of Products
E. A. Gastrock, Head, Engineering and Development Division, SRRL

7. 2:00 Improvement in the Hydraulic Method of Processing Cottonseed
Professor G. H. Hickox, Engineering Experiment Station, University of Tennessee

8. 2:30 High Capacity Expeller Pressing on Cottonseed
J. W. Dunning, A. P. Holly, and Dean K. Bredeson, V. C. Anderson Company, Cleveland, Ohio

3:00 Discussion

March 10, 1953 - 9:00 a.m.
Auditorium - Third Floor

Ralph Woodruff, Chairman
Valley Association Research Committee

M. C. Verdery, Chairman
Sub-Committee on Cottonseed Cleaning

F. M. Wells, Chairman
Sub-Committee on Lint Cleaning

9. 9:30 a.m. Definition of Problems
Ralph Woodruff, Committee Chairman
Osceola Products Company, Osceola, Arkansas

10. Report by the Sub-Committee on Seed Cleaning
M. C. Verdery, Chairman
Anderson, Clayton and Company, Houston, Texas

11. 10:15 a.m. Developments in Cottonseed Cleaning in Texas
Dick Taylor,
Southland Cotton Oil Company, Waxahachie, Texas

12. 10:45 a.m. Use of Air Separators in Cleaning Bolly Cottonseed
Allen Smith
Perkins Oil Company, Memphis, Tennessee

13. 11:30 a.m. Recent Developments and Experience in Cleaning Cottonseed
M. D. Woodruff, and M. E. Ginaven
The Bauer Bros. Company, Springfield, Ohio

12:30 p.m. Luncheon - S.R.R.L.

March 10, 1953 - 1:30 p.m.
Auditorium - Third Floor

Ralph Woodruff, Chairman
Valley Association Research Committee

14. 1:30 p.m. Sub-Committee Report
F. M. Wells
The Buckeye Cotton Oil Company
Cincinnati, Ohio

15. 1:40 p.m. Developments in Centrifugal Separators
Lucian Cole
Industrial Machinery Company
Fort Worth, Texas

16. 2:10 p.m. Pneumatic Lint Cleaning
M. C. Verdery, Anderson, Clayton and Company, Inc.,
Houston, Texas.

17. 2:40 p.m. Description of the Whirligig
Redding Sims, National Blow Pipe and Manufacturing Company,
New Orleans, La.

18. 3:10 p.m. The Relationship of Foreign Matter Content of Cottonseed to the Amount of Equipment Used in Gins for Cleaning Seed Cotton
Francis L. Gerdes, In Charge, Stoneville Cotton Laboratory
Research and Testing Division, Cotton Branch,
Stoneville, Mississippi

19. 3:40 p.m. Use of Pneumatic Linter Attachments
Allen Smith
Perkins Oil Company, Memphis, Tennessee

20. 4:10 p.m. Cleaning Cotton Linters
T. P. Wallace
Carver Cotton Gin Company
Memphis, Tennessee

21. 4:30 p.m. Report of the Sub-Committee on Lint Cleaning
F. M. Wells, Chairman

****

ATTENDANCE LIST

Andrews, John P., Lukens Steel Co., Coatesville, Pa.
Annis, B. B., 64 Madison Avenue, Memphis, Tenn.
Bartmess, N. P., Kennett Oil Mill, Kennett, Missouri
Barton, R. C., General Supt., The Forrest City Cotton Oil Mill, Forrest City, Ark.
Blalock, Hill, Asst. Manager, Riverside Oil Mill, Marks, Miss.
Boaz, Richard, Buckeye Cotton Oil Co., Little Rock, Ark.
Brawner, J. H., Asst. to Gen Mgr., Southern Cotton Oil Co., New Orleans, La.
Bredeson, Dean K., Sales Eng., V. D. Anderson Co., Cleveland, Ohio
Bremer, J. W., Swift and Co., Union Stock Yards, Chicago 9, Ill.
Brooke, Tom R., S. E. Representative, French Oil Mill Machinery Co., Atlanta, Ga.
Byram, J. E., Exec. Vice President, Red River Cotton Oil Co., Inc., Alexandria, La.
Caldwell, C. H. Perkins Oil Co., Memphis, Tenn.
Cantrell, Wm. C., Sales Representative, Bauer Bros., Springfield, Ohio.
Carter, Clyde L., Engineering Exp. Station, The Univ. of Tenn., Knoxville, Tenn.
Cole, L. U., Industrial Machinery Co., 2400 South Main St., Fort Worth, Texas
Coleman, W. T., Divn. Chief Chemist, Western Cotton Oil Co., Div. Anderson Clayton and Co., Abilene, Texas
Covington, H. E., President, Miss. Cottonseed Products Co., Standard Life Building, Jackson, Miss.
DeField, E. O., Sikeston Cotton Oil Mill, Sikeston, Missouri.
Dillard, E. L., Supt., Dothan Oil Mill Co., Dothan, Ala.
Dunning, Jno. W., c/o V. D. Anderson Co., 1935 W. 96th St., Cleveland 2, Ohio.
Durham, Warren A., Sales Engineer, National Blow Pipe and Mfg. Co., New Orleans, La.
Edmondson, T. S., District Manager, Ft. Worth Steel and Machinery Co., Memphis, Tenn.
Fackler, H. V., Lukens Steel Co., Coatesville, Pa.
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White, H. B., Decatur Cotton Oil Co., Decatur, Ala.
Wiley, A. L., Perkins Oil Co., Memphis, Tenn.
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SUMMARY

(This summary of the conference was furnished on March 20, 1953, to trade and technical journals serving the oilseed industry.)

Research on Cleaning Cottonseed and Linters Urged at Clinic

Better cleaning of cottonseed and better cleaning of linters -- the siamese-twin problems of cottonseed oil mills -- were featured at the Second Cottonseed Processing Clinic held March 9-10 at the Southern Regional Research Laboratory of the U. S. Department of Agriculture, Bureau of Agricultural and Industrial Chemistry in New Orleans, Louisiana.

Ralph Woodruff, Osceola Products Company, Osceola, Arkansas, Chairman of the Research Committee of the Valley Oilseed Processors Association, stated that better cleaning of seed and better cleaning of linters cannot be separated they go hand in hand. He added: "A great many of us are working on these problems individually, but we feel that we need a clearing house for exchange of information and because it will take all of us working together fast to assure ourselves of a ready sale for our linters in the future. So with these objectives in mind we have arranged this meeting and a program which will afford an opportunity to appraise the progress being made, and spotlight the time and serious effort the processors and machinery manufacturers are devoting to solution of the problem, as well as to determine a future course of attack."

Eighty-nine representatives of the cottonseed industry, state universities and state experiment stations and other federal agencies met with members of the Southern Laboratory staff in this working conference called jointly by the Valley Oilseed Processors Association and the Bureau of Agricultural and Industrial Chemistry.

Members of the VOPA adopted the following resolution at the close of the meeting: "That this second clinic has stimulated the interest of large numbers of industry. It has brought about a much better understanding of the problems involved which should lead to the continuance of a beneficial research program.

"It is recognized by this group that basic or fundamental research is important and essential, but it is also our feeling that applied research is of equal importance. It is our hope that we can present to the SRRL staff from time to time some of the pressing problems that confront this industry.

"As one of the evident demonstrations of applied research, we have found the pilot-plant facilities of the Laboratory to be of special interest. We would like to see these facilities expanded, if necessary, to undertake new studies that may arise."

M. C. Verdery, Anderson Clayton and Company, Houston, Texas, Chairman of the Subcommittee on Cottonseed Cleaning, and F. M. Wells, Buckeye Cotton Oil Company, Cincinnati, Ohio, Chairman of the Subcommittee on Lint Cleaning, discussed these problems on an industry-wide basis and made detailed recommendations for further work. Recent developments and experience in cleaning

cottonseed were presented by W. C. Cantrell and M. E. Ginaven of the Bauer Brothers Company, Springfield, Ohio. The use of air separators in cleaning bolly cottonseed was discussed by Allen Smith, Chemist, of Perkins Oil Company, Memphis, Tennessee. The developments in cottonseed cleaning in Texas were covered by Dick Taylor, Southland Cotton Oil Company, Waxahachie, Texas; and the cleaning of cottonseed and removal of hulls, meats, etc., between linter cuts were discussed by the respective subcommittee chairmen. Discussing "Developments in Centrifugal Separators," Lucian Cole, Industrial Machinery Company, Fort Worth, Texas, reported on the results of the first year's experience with these machines. Francis L. Gerdes, USDA, Stoneville Cotton Laboratory, Stoneville, Mississippi, spoke on "Application of Seed Cotton Cleaning Equipment to Cottonseed and Linters." He stated that the ginner loses by having to haul additional weight to the oil mill and also by having the seed bring a lower price because of reductions in grade due to excess foreign matter. T. P. Wallace, Carver Cotton Gin Company, Memphis, Tennessee, advocated the processing of smaller quantities of lint per machine with the pneumatic linter attachment. "The smaller the volume, the better the grade," he added. Allen Smith said there must be a change in cottonseed cleaning equipment or new designs are necessary as "The present machines just aren't doing what we want them to do."

Progress in USDA research on cottonseed utilization at the Southern Laboratory and under research contracts was reported on the opening day by T. H. Hopper. He outlined the areas of research involved in covering all phases of seed processing and of product utilization. These areas included composition of the cottonseed, processing of the seed, oil research, development of new products from cottonseed oil, fat emulsion investigations, and fundamental and background research such as determination of physical and chemical properties of oils and proteins and development and refinement of analytical methods. He pointed out that the work of the Eastern Laboratory on animal fats and of the Northern Laboratory on soybeans and soybean oil, while not a part of the cottonseed program, contributes helpful basic information and that the different programs are mutually beneficial. He emphasized the need to maintain a broad perspective as to areas in which research is needed to keep the cottonseed economy in balance. A. M. Altschul, Southern Laboratory, discussed research on conditions of processing to improve the quality of the oil and meal. This research, which is being conducted in cooperation with experiment stations, the National Cottonseed Products Association, the cottonseed industry, and other bureaus of the Department of Agriculture, has pointed the way to the more extensive utilization of cottonseed meal as a source of protein in hog and poultry rations, as well as in feed for cattle. E. A. Gastrock, Southern Laboratory, reviewed pilot-plant experiments on relationship of conditions of processing in preparing cottonseed to processing efficiency and quality of product. G. H. Hickox, University of Tennessee, Knoxville, stated that experiments for the Department of Agriculture at the University on hydraulic pressing of cottonseed could help the cotton oil mill decrease the residual oil left in the cake by 1/2 to 1-1/2%.

J. W. Dunning, V. D. Anderson Company, Cleveland, Ohio, reported that tests during the last three years on the preparation of cottonseed have permitted the doubling of the capacity of an expeller unit producing cottonseed oil and that about 24 mills have converted to press cottonseed by this method during the past 18 months.

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